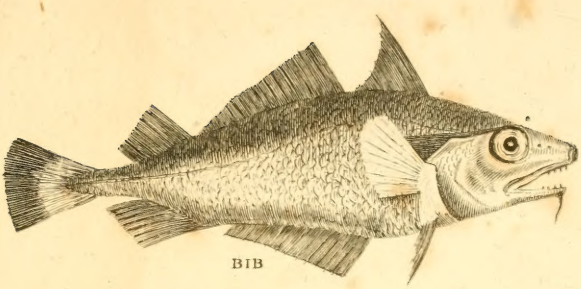
Plate XVI



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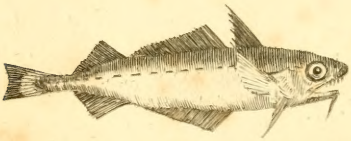

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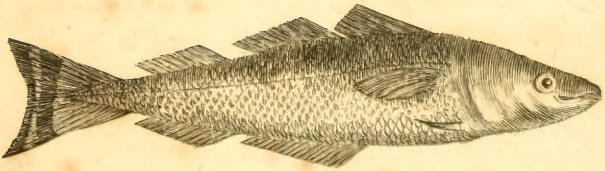

COAL FISH

FORKED HAKE

Ann. W. Clark
597
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# A NEW SYSTEM

OF THE

# NATURAL HISTORY

OF

# FISHES AND INSECTS.

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——Volucrumque genus.

BUCH. SAT. IN CAR. LOTH. CARD.

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# NATURAL HISTORY

OF

# FISHES.

## CHAPTER I. OF FISHES IN GENERAL.

### SECT. I.—*History of Ichthyology.*

In the early periods of ſociety, the neceſſities and wants of men, rather than their curioſity, prompt them to pay attention to the different objects, which the munificent Author of nature has placed around them: And, though fiſhes conſtitute a greater part of the ſubſiſtence of men, in their rude and ſavage ſtate, than perhaps in any future ſtage of their political exiſtence, yet their acquaintance with this part of the animal kingdom, in the earlier ages of ſociety, is by no means extenſive. A few ſpecies that are moſt common, or moſt eaſily taken in the neareſt river or lake, are all that the neceſſity of the ſavage requires; and, as in him, curioſity has not yet begun to be a ſteady principle of action, it ſeldom leads him to examine more.

Even after nations have attained to some degree of knowledge and civilization, many ages elapse before they push their inquiries far into the subject of ichthyology, or acquire any considerable acquaintance with the inhabitants of the ocean. In the unfathomed depths of that turbulent and extensive element, probably millions reside, of which the far greater part are secluded from human observation; and, even of the few which the industry of man has, at last, drawn from their hidden abode, we hardly know any thing, but the external figure, and the names. Their food, their longevity, their method of propagating their kind, and the whole of their manners and economy, remain still among those numberless secrets of Nature, which human ingenuity has not hitherto been able to explore. Hence, the natural history of fishes has seldom been found interesting, because it is destitute of that information, which it is the province of history to convey. It is more imperfect and obscure, than that of quadrupeds and birds, in proportion as the element, in which fishes reside, is more extensive and inaccessible.

Before the *Christian* era, few writers had turned their attention to this difficult branch of Natural History. *Aristotle*, *Theophrastus*, *Strabo*, and *Terentius Varro*, had made their observations on such as were then known; but they had scarcely any idea of treating the subject in a scientific manner. After that period, *Appian*, *Ovid* and *Columella*, described the fishes of the *Euxine* and *Adriatic* seas, as far as they had access to examine them. *Pliny* was the last, and by far the most copious writer upon this subject, among the ancients. He is, indeed, too diffuse; while his credulity and love of the marvellous, considerably weaken the authority of his narrative. An hundred and twenty-four species, were

were all that the aſſiduity of the ancient naturaliſts had diſcovered.

During the decline and fall of the *Roman* empire, attention to ichthyology, as well as to every other part of literature, was entirely laid aſide; nor did the pernicious effects of the *Gothic* invaſions, allow it to be reſumed, till the year 1524, when *Paulus Jovius* *, an *Italian* writer, gave an account of thoſe fiſhes, that were known to the ancient *Romans*. After him, various local hiſtorians appeared. *Belonius* and *Rondeletius* ſucceeded each other in deſcribing the fiſhes of the *Mediterranean*; while *Swinfield*, *Marcgrave*, and *Cateſby*, gave, ſucceſſively, an account of the fiſhes of *Sileſia*, *Braſil*, and the *Carolinas*.

While ichthyology was thus enriched by hiſtorians of particular diſtricts, there were other naturaliſts, who engaged in this ſcience in a more general and ſyſtematic manner. The Honourable *Francis Willoughby* publiſhed, in 1686, a hiſtory of fiſhes, which is ſtill deemed one of the moſt valuable upon this ſubject. He was afterwards followed by *Artedis* and *Linnæus*, who carried the ſcience to a greater degree of perfection, than it had ever hitherto attained.

If we take into account the vaſt number of fiſhes, of which the very names have not yet found a place in the ſyſtems of naturaliſts, we muſt neceſſarily conclude, that this part of ſcience, is ſtill in its infancy. Some very ſkilful ichthyologiſts aſſert, that there are to be found in the different collections of fiſhes about *London*, ſix hundred kinds not enumerated by *Linnæus*; and we may, perhaps, eaſily admit, that there are yet, in the unfathomable depths of the ocean, at leaſt an equal num-



* De piſcibus Romanis.

ber, that have not come into the poſſeſſion of the curious.

It is remarkable, that there is no ſyſtem of ichthyology in the *Engliſh* language. *Goldſmith's* plan did not admit of any thing more, than a general ſketch of this ſubject. Accordingly, he has not deſcribed, perhaps, a twentieth part of thoſe, that are already found in the ſyſtems of *Artedi* or *Linnæus*. *Pennant* has, indeed, given a correct and elegant hiſtory of the *Britiſh* fiſhes; but theſe make only a ſmall part of the inhabitants of the ocean. We dare not promiſe, in the narrow limits of the following work, to offer a complete ſyſtem to the public. All the genera, however, are included, and a few of the moſt remarkable ſpecies belonging to each, are ſelected for a particular deſcription.

By the labours, however, of the different philoſophers already mentioned, nearly five hundred kinds of fiſhes have been enumerated, and deſcribed; and, in appearance at leaſt, conſiderable progreſs has been made in explaining their hiſtory: But, unfortunately, the names and external figure of many of theſe are all that we know. Their food, migrations, manner of life, and every quality that can render their hiſtory intereſting, ſtill remain to be explored. While, therefore, we are guided principally by the arrangement of *Linnæus*, in giving the following account of fiſhes, we will ſpare our readers the trouble of peruſing the tedious catalogue, as often as it preſents nothing, but the dry detail of names. We ſhall thus ſecure ourſelves an opportunity of enlarging more fully upon thoſe particular fiſhes, whoſe hiſtory may appear moſt authentic, curious, or uſeful.

*Ariſtotle*, that great father of naturaliſts, firſt ſuggeſted the excellent arrangement of fiſhes, into the *cetaceous*, *cartilaginous*,

*cartilaginous*, and *ſpinous*. *; which, as far as it goes, ſeems impoſſible to be altered for the better †. *Rondeletius*, the firſt naturaliſt, who, after the revival of learning, turned his attention to this ſubject, attempted to lay aſide the *Ariſtotelian* diviſion, and to ſubſtitute, in its room, another, founded upon the habitation of fiſhes, or thoſe places where they reſide. He, accordingly, claſſed them into the fiſhes of the *ſea*, *rivers* and *lakes* ‡. Since, however, many fiſhes reſide indiſcriminately in all theſe ſituations, this method was abandoned by *Willoughby* and *Ray*, who again reſumed the arrangement of *Ariſtotle*; and, the celebrated *Linnæus* has added to it ſome farther ſubdiviſions, which render it ſtill more uſeful.

The *cetaceous* fiſhes have, in the later editions of his works, been claſſed among the quadrupeds; the *cartilaginous* have been referred to the amphibious tribes, among which they conſtitute a particular order §; while the *ſpinous* or *bony*, are alone allowed to retain the name of *fiſhes*.

As we have already hinted, that we are to paſs by, or but ſlightly mention, ſome ſpecies enumerated by that naturaliſt, whoſe manners are not intereſting, or but imperfectly known; ſo, on the other hand, we ſhall reſtore to their natural ſtation among the finny tribes, the *cetaceous* and *cartilaginous* fiſhes, which he has baniſhed from that part of the animal kingdom.

The grand claſſical characters, which nature has imprinted on the *cetaceous* order, will, in a philoſophical view,

* Hiſt. Animal.

† The *firſt* comprehends the *whale* kind; the *ſecond*, thoſe whoſe fiſh is ſupported by *cartilages*; and the *third*, thoſe whoſe muſcles are ſupported by *ſpines* or *bony matter*.

‡ *Marini*, *Fluviatiles*, and *Lacuſtres*.

§ *Amphibia Nantia*, *Lin.* Syſt. Nat. Ed. 12.

view, vindicate their arrangement among quadrupeds. Their internal ſtructure agrees, in every reſpect, with that of the *mammalia quadrupedia* of *Linnæus*; and their external conformation alſo is, in ſome parts, ſimilar.

The cetaceous fiſhes are deſtitute of gills: They breathe by means of lungs, and, on that account, are obliged to riſe frequently to the ſurface of the water for reſpiration *. They reſemble land animals too in having warm blood; in being provided with external organs of generation; and in their manner of copulating and bringing forth their young, which they ſuckle, and protect with parental attachment. They have the power of uttering ſounds †, ſuch as of bellowing and making other noiſes; a faculty denied to the other inhabitants of the deep.

But notwithſtanding this ſtriking ſimilarity between the cetaceous fiſhes, and the land animals, there are many other properties belonging to the former, which muſt determine us to rank them among fiſhes, where the general voice and language of men have always placed them. The *ſeals*, *manati* and *whales*, are evidently the ſteps, by which Nature proceeds from the one of theſe her great families to the other: Here they approximate, and appear kindred tribes. In the laſt of theſe ſpecies of animals however, the great outlines and form of a fiſh predominate: It is entirely naked, or covered with a ſmooth ſkin; it lives wholly in the water, and has all the actions and habits of its aquatic neighbours ‡.

It is with much greater confidence and facility, that we reſtore to their original ſtation, the *cartilaginous* fiſhes;

* *Vide* Britiſh Zoology.

† *Blaſſie's* Anat. Animal. 288.

‡ Vide *Raii* Synop. Piſc.

fiſhes; becauſe greater violence has been uſed in excluding them from it. They are by no means capable of living indiſcriminately in the water and on ſhore, and, therefore, merit not the name of *amphibious*, which *Linnæus* has aſſigned them. The ſingle circumſtance, by which that naturaliſt determined their rank in the animal kingdom, is the want of the *bony operculum*, or covering of the gills, which is common to the *ſpinous* fiſhes.

This laſt order, which alone he admits to be fiſhes, he has very properly ſubdivided into four different ſections, the *apodal*, the *thoracic*, the *jugular*, and *abdominal* fiſhes *. This arrangement is founded on the compariſon of the ventral fins to the feet of land animals; and the particular ſituation of theſe fins with reſpect to the reſt, determine the place, where each fiſh is to be ranked.

The *apodal* fiſhes, are ſuch as want the ventral fins altogether, ſuch as the *ſword-fiſh* and *eel*. In the *jugular*, the ventral fins are placed before the pectoral, as is exemplified in the *cod-fiſh* and *blenny*. The *thoracic* are diſtinguiſhed by having the ventral fins placed beneath the pectoral, as is illuſtrated by the *mackrel*, or *father-laſher*. The *abdominal* fiſhes are known, by having the ventral fins placed behind the pectoral fins, near to the abdomen, as is the caſe in the *ſalmon* and *pike*. This diviſion of fiſhes, according to the ſituation of their fins, is exceedingly judicious and natural. It firſt occurred to *Linnæus*, when examining a collection of prepared ſubjects, in the preſence of Dr. *Sollander*, who witneſſed the extaſy of this indefatigable naturaliſt on making this diſcovery †.

SECT.

* *Vide* Syſtema Nat. p. 422.

† He uſed the exclamation of the *Grecian* mathematician *Archimides*. Εὑρηκα.

## Section II.

### *Of the external Parts and Motion of Fiſhes.*

The external form of the greater part of fiſhes, tends greatly to the eaſe and celerity of their motion. It is ſharp at either end, and ſwelling towards the middle; and is modelled by nature after that ſhape, which we endeavour to imitate in thoſe veſſels, that are intended for the greateſt deſpatch. Every human contrivance, however, falls far ſhort of the rapidity of the natives of the ſea. All the larger fiſhes can eaſily overtake the beſt conſtructed veſſel while in full ſail; and play around it, without any apparent effort.

The principal inſtrument of this great velocity in fiſhes, is the tail, aided by the ſtrength and flexibility of the back-bone. The other fins are too ſmall, ſlender, and flexible, compared with the weight of the animal, to impel it through the water with ſuch vaſt rapidity and force. Their principal uſe is to direct and moderate the movement, communicated by the impulſe of the tail. A fiſh, when deprived of theſe, and put into a pond, darts upwards, downwards, and laterally, with all its wonted velocity, but without being able to direct its courſe *. The ventral and dorſal fins, ſerve the purpoſe of keeping the fiſhes in an erect and perpendicular poſition; and, perhaps, the firſt contributes to raiſe or ſink them in the water. The pectoral fins regulate and aſſiſt progreſſive motion. When ſwimming rapidly forward,

* *Borelli* apud *Will.* de motu anim.

ward, fiſhes can, by extending theſe, ſtop their motion, and produce *mora*; and, when ſwimming in a ſtreight direction, they can, by folding either, while the other continues to ply, direct their motion to that ſide. The ſize of theſe fins, is, in general, proportioned to that of the head of the fiſh to which they belong; and it is probably one uſe of them, to prevent the fiſh from being overbalanced by the weight of its head, and precipitated to the bottom. In ſome fiſhes, the pectoral fins ſerve the ſame purpoſe as the wings of birds; for, by their means, they are enabled to riſe from their watery element, and to fly for a conſiderable ſpace, till their fins be ſo dried by the air, that, in ſpite of every exertion, they again ſink into the water.

A fiſh completely equipped for ſwimming, has ſeven fins, two pairs, and three ſingle ones; and of the latter, two are above, and one below: But, ſince thoſe which have the greateſt number of fins, are not the ſwifteſt, it has been concluded, that the tail is the principal cauſe of the ſwiftneſs of a fiſh's motion. When in purſuit of its prey, or avoiding an enemy, all the ſmaller fins are laid cloſe to its body; then, by the impulſe of the tail alone, it ſkims through the water with the incredible velocity of a dart or an arrow * The muſcles, by which the tail is moved, are, by far, the thickeſt and ſtrongeſt of the whole body; and to give direction to the great impetus which they communicate to the fiſh, ſeems to be the chief purpoſe of all the ſmaller fins.

The motion of fiſhes, is ſuppoſed to be aſſiſted by the ſwimming bladder, which, by contraction and dilatation, ſerves to raiſe or ſink them in the watery element at pleaſure; and, as that element is of very different degrees



* Willoubii Ichthyol. p. 4.

of weight, according to its depth, the fiſhes, by thus varying their ſpecific gravity, can poiſe themſelves in any part of it *. That this is the uſe of the air bladder, ſome naturaliſts pretend to have aſcertained by experiment: An inciſion made into this organ, by which the air is allowed to eſcape, obliges the fiſhes, after ſome efforts, to ſink to the bottom of the water. This opinion ſeems to receive confirmation from the manners of thoſe kinds where it is wanting. All flounders and ground-fiſhes are deſtitute of a ſwimming bladder; and, by conſequence, lie conſtantly at the bottom; while the cetaceous and cartilaginous orders, which often ſupport themſelves at the ſurface, without the aid of this inſtrument, are ſupplied with lungs, which ſerve the ſame purpoſe, by admitting the air, in much greater quantity, into the cavity of their bodies.

So far this matter ſeemed to be clear; but, upon examining this ſingular organ, it appeared to be ſupplied with no muſcles that could enable the animal to contract or dilate it, in a voluntary manner. Two other opinions have, therefore, been formed concerning the uſe of the ſwimming bladder. Dr. *Needham* obſerved, that in the greater part of fiſhes, whether this organ was ſingle, as in ſome ſpecies, or double, as in others, it was furniſhed with a duct or canal that opened into the ſtomach: Hence he concluded, that its uſe was to collect the air ſecreted from the blood, and to convey it into the ſtomach, where it aſſiſted the proceſs of digeſtion †. In this manner, he endeavoured to account for the extraordinary voracity of fiſhes, and their uncommon powers of digeſtion.

No

* Willoubii Ichthyol. p. 13. † De formato fœtu, ch. vi.

No philoſopher ſeems yet to have made obſervations ſufficiently accurate, fully to determine this matter; for it is not yet aſcertained, whether the neck of the canal be ſupplied with a valve to emit air ſecreted from the blood, or to receive it from the ſtomach, or with a muſcle that may equally ſerve to admit, or eject it: And what militates againſt *Needham's* opinion, is, that the cartilaginous fiſhes, which have nothing of this kind to aid their digeſtive powers, are as remarkable for voracity as any other kind.

The other uſe to which naturaliſts have deſtined this organ is, to ſerve as a receptacle for air, inſtead of the lungs in terreſtrial animals, by which the neceſſities of theſe creatures may be ſupplied. The air bladder of fiſhes is confined in a triangular ſpace at the upper part of the abdomen, and conſiſts of one, two, and ſometimes three diviſions, all ſeparated from the reſt of the viſcera by a thin membrane, attached, on each ſide, to the ribs. An apparatus of this kind, though we be not able to explain its uſe, no one can imagine was formed in vain. It is poſſible, that it may ſerve ſome purpoſe different from any of the above, and probably more than one even of theſe.

Fiſhes thus fitted for motion in their element, by their internal ſtructure, as well as by their outward ſhape, and the ſituation of their fins, ſeem as well furniſhed with the means of happineſs, as either quadrupeds or birds. Like theſe they are furniſhed with an external covering, to defend them from injuries in the turbulent fluid which they inhabit. That ſlimy and glutinous ſubſtance, which is ſecreted from the pores of all fiſhes, not only defends their bodies from accident, but is happily contrived to give little obſtruction to their progreſs through the water. Beſides this ſubſtance, which defends their bodies

from the immediate contact of the furrounding fluid, the greater part of fifhes are provided with a ftrong covering of fcales, which ftill more powerfully protects them from injury; and, beneath this, they are fupplied with an oily matter, which preferves the body in warmth and vigour.

When, however, we examine the fenfes, and other faculties, of this part of the animal kingdom, we find it in a rank greatly below the other tribes; and that Nature having intended them for lefs perfect beings, has been fparing in her endowments. The brain, the feat of fenfation, is much fmaller in fifhes, than in other animals; and, probably, gives off a fmaller number of nerves to the different parts of the body *. Thofe ftrong teguments, with which we have obferved that their bodies are covered, muft greatly obftruct their fenfe of touch, which, in all probability, is far from being delicate.

The external organs of fmell, and the nerves which fupply them, are perceptible in the greater part of fifhes; and, even where the apparatus is not difcernable without, the formation of the bones within, plainly indicate an apparatus for this purpofe. But as air is the only medium we know for the diftribution of odours, it cannot be fuppofed, that thefe animals, refiding in water, can be poffeffed of any capacity of being affected by them. If they have any perception of fmells, it muft be in the fame manner as we diftinguifh by our tafte; and it is probable, that the olfactory membrane in fifhes, ferves them inftead of a diftinguifhing palate: By this they judge of fubftances, whofe vapours, having tinctured the water, are fent to their noftrils, and, no doubt, produce

* Williſius de anat. cerebri apud Willoubium.

produce ſome kind of ſenſation. This, moſt probably, is the uſe of that organ in theſe animals; as, otherwiſe, they would be provided with the inſtruments of a ſenſe, which they could not enjoy from want of an opportunity of uſing them *.

The ſenſe of taſte in fiſhes muſt be very imperfect, if its delicacy ariſe from the pliancy and ſoftneſs of the organ. The whole mouth of fiſhes is covered with a hard bony ſubſtance, which muſt deprive them of almoſt all power of diſtinguiſhing different ſubſtances by the palate: Their voracity, accordingly, is ſo indiſcriminate, that there is hardly any kind of food which they will not ſwallow: They devour the fiſherman's plummet inſtead of the bait.

All fiſhes, except the cetaceous, are deprived, not only of external ears, but alſo of the auditory nerves and canal. Of the ſenſe of hearing, therefore, it is probable, that they are altogether deſtitute †. As they are incapable of uttering ſounds, they could ſeldom have an opportunity of hearing, even though Nature had endowed them with that power. They have no voice to communicate with each other, and, conſequently, have no need of that organ by which it is diſcerned. The whales, and perhaps the cartilaginous fiſhes, are found poſſeſſed of ſmall apertures for the admiſſion of ſounds; but, even in theſe, this ſenſe muſt, from the ſmallneſs of the organ, be very imperfect.

Naturaliſts, determined by theſe reaſons, ſeem, in general, agreed, that all the ſpinous fiſhes are deſtitute of the faculty of hearing. *Linnæus* who has probably examined a greater number of ſubjects, and with more accuracy than any other philoſopher, confeſſes, that he has

* Goldſmith's Nat. Hiſt. vol. 6. p. 160.

† Raius apud Will. c. iv. lib. 1. de piſc. auditu.

has not been able to discover any auditory organs in this class of the animal kingdom*. Mr. *Klein*, however, imagines he has found out organs of this sense; and he has allotted for that purpose, those bones which are found in the head of some fishes †. But these are so dissimilar to the organs of hearing in other animals, that it is improbable, that Nature intended them for that purpose; and, besides, there are many species, in which they are not to be discovered.

But although Nature, in their conformation, had made a provision for the hearing of fishes, that sense must have been extremely limited and imperfect, from the nature of the element which they inhabit. Experiments have been made on the capacity of water to transmit sounds; and by these it has been found, that it is capable of conveying them but a short way; for it quickly deadens that vibration upon which they depend. A man whose head is one foot immersed in water, hears voices and words uttered in the air; but, when sunk to the depth of twelve feet, he scarcely hears a musket shot, though discharged over his head. Hence it is probable, that Nature has made no organic apparatus to convey sounds to fishes, since she has forever consigned them to an element, which must, in a great measure, have defeated its purpose.

*Rondeletius* ‡, and several of the old naturalists, who plead for the hearing of fishes, allege, in proof of it, that certain kinds of them are so affected with noise, that they become unwholesome after thunder; and that, in ponds where they are tamed, in some places of *Germany*, they are convened regularly by the call of a bell to their food.

* Systema Naturæ. † *Vide* Historiam Piscium.

‡ Rondel. de piscibus, lib. 7. cap. 14.

food. But the experiments made by Mr. *Gorian* *, profeſſor of medicine at *Montpelier*, clearly demonſtrate the fallacy of theſe proofs. The gold fiſhes, which he kept in vaſes, he could never diſturb by the loudeſt noiſe, provided he could prevent the tremor of the air from affecting the water. It appears, therefore, that fiſhes are as deſtitute of hearing as of voice; and that, when they appear to come to their food at the call of a bell or whiſtle, it is either by feeling the vibrations of the ſound affect the water, or by ſeeing the perſons approach by whom they are accuſtomed to be fed †.

The ſight of fiſhes is probably the moſt perfect of all their ſenſes, and yet it is far inferior to that of moſt other animals. They have, properly ſpeaking, no eye-lids: Their ſight is protected in the water by a nictating membrane, which is a continuation of the ſame tranſparent ſkin that covers the reſt of the head. The cryſtalline humour, which in moſt other animals is flat, is in them convex, and round like a ball ‡. In conſequence of this, theſe animals muſt be near-ſighted, even in water, which, like a concave glaſs, corrects, in ſome degree, this defect of the organ of viſion. We have no evidence of any fiſhes ſeeing at a conſiderable diſtance; and the caſe with many of them, that are deceived by the different kinds of bait prepared in imitation of their food, gives room to ſuſpect, that objects are not very diſtinctly perceived by them, even when near.

From this ſhort account of the external ſenſes of fiſhes, it muſt appear, that their faculties, in point of perfection, fall greatly below thoſe of the other tribes, which have already

* Hiſtoria Piſc. † Linnæi Syſtema Naturæ.
‡ Goldſmith's Nat. Hiſt. vol. vi.

ready been reviewed in the preceding part of this work. In every thing reſembling intelligence, their inferiority is equally ſtriking. They are incapable of attachment, or of acquiring any new habits by domeſtication and intercourſe with man. Some faint traces, indeed, of memory they diſcover, if it be true, as is alleged, that they regularly return to the place where they have been fed *; but even this ſmall ſhare of recollection, can hardly be allowed them without heſitation; for they may be aſſembled there, merely by ſeeing one of their number pick up the remains of the food which they had formerly left. It forms no exception to the general concluſion, that all their powers and faculties are of a ſubordinate kind, ſuited to that humble and paſſive exiſtence which Nature has aſſigned them. To preſerve exiſtence, and to continue it to poſterity, fill up the whole circle of their purſuits and enjoyments, to which they are impelled rather by neceſſity than choice. While they ſeem mechanically excited to every fruition, their ſenſes are incapable of making any diſtinctions; and they are hurried forward in purſuit of whatever they can ſwallow, conquer, or enjoy †.

* Willoub. Hiſt. Piſcium, cap. iii.

† Goldſmith, Nat. Hiſt. vol. vi. p. 164.

## Section III.

### *Of the Reſpiration, Food, &c. of Fiſhes.*

In all animals, reſpiration, or the admiſſion of air into the body, ſeems neceſſary to the ſupport of life. From the experiments that have been made upon fiſhes, almoſt in the infancy of ſcience, it appears, that they are incapable of ſubſiſting without air for any conſiderable time. The cetaceous and cartilaginous fiſhes, are ſupplied with the neceſſary quantity of this fluid, by means of lungs like the terreſtrial animals; and hence the *Swediſh* naturaliſt has arranged them in the ſame claſs of beings *. In the ſpinous fiſhes, reſpiration is performed by *branchiæ*, or gills, without the cavity of the body; but the preciſe manner in which this operation is carried on, is one of thoſe ſecrets of Nature, which neither the glaſſes nor the knife of the anatomiſt have ever yet been able to develope. The manner, indeed, in which the air is tranſmitted from the lungs of quadrupeds into the blood, is perhaps equally myſterious, as its paſſage from the branchiæ of fiſhes into the arteries leading to the heart. This difficulty *Artedi* confeſſes †; and *Rondeletius*, *Needham*, and other philoſophers, have in vain endeavoured to explain it.



* *Vide* Syſtema Naturæ, laſt edition.

† Quomodo aer intret branchias piſcium, difficile eſt dictu.

The gills, it would appear, have a power of abſorbing the air, without giving admiſſion to the water which is received into the mouth, and ejected by the branchiæ, at each movement of the opercula which cover them; but in what manner the ſubtile ſeparation is performed, no naturaliſt has ever ventured to declare. As the air and water paſs quickly through the gills, without any apparent effort to ſeparate them, it is probable, that only a ſmall quantity of the former is abſorbed, but that, by the frequent tranſition of the water, a ſufficient quantity of it may be admitted to ſupply animals whoſe blood is naturally cold, and not in great abundance *.

But, however ſmall a quantity of air may ſuffice to ſupport the life of a fiſh, ſome portion of it is abſolutely neceſſary to every living being. Some have been ſhut up in a narrow mouthed veſſel, and have lived there for ſeveral years; but the air is no ſooner excluded, by ſtopping up the opening, than the animals are ſuffocated in the courſe of a few minutes. When this experiment was repeated with the veſſel filled half with water, and half with air, after covering the mouth, as the air below began to be exhauſted, the fiſhes were ſeen ſtruggling to riſe above one another, and inhale a ſmall ſupply at the ſurface of the water; and the ſame conſequence will follow, if you faſten down the opercula of the gills with a ſtring, ſo that reſpiration cannot be performed †. This probably is the cauſe why ſo many fiſhes are deſtroyed in rivers by ſevere froſt: When, by the congelation of the whole ſurface of the water, the external air is excluded, the animals below muſt neceſſarily periſh ‡.

*Aelian.*

* Willoughby, lib. i.
† Rondelet. lib. iv.
‡ Willoughby, cap. v.

*Ælian* mentions a method of taking fiſhes in the river *Iſter*, founded upon this obſervation. In the rigour of winter, the fiſhermen broke ſmall holes through the ice. The ſuffocating animals inſtantly crouded to the aperture, in order to procure a ſupply of air; and ſo eager were they to obtain it, that rather than abandon the attempt, they ſuffered themſelves to be caught with the hand.

Next to the neceſſity of breathing air, that of devouring food ſeems to be the moſt conſtant and urgent in the nature of fiſhes. Among them this appetite, both in ſtrength and avidity, ſeems to ſurpaſs thoſe limits which Nature has preſcribed to herſelf in the other orders of the animal kingdom. Every aquatic animal that has life, falls a victim to the indiſcriminate voracity of one or other of the fiſhes. The ſmaller tribes devour inſects, worms, or the ſpawn of the reſt of the tenants of the waters; while they, in their turn, are purſued by millions larger and more rapacious than themſelves. A few of them feed upon mud, the aquatic plants or grains of corn; but by far the greater numbers ſubſiſt upon animal food alone; and of this they are ſo voracious, that they ſpare not even thoſe of their own kind *. Charr kept in a pond, if ſcantily ſupplied, frequently devour their own young. Others that are larger, go in queſt of a larger prey; it matters not of what kind, whether of another ſpecies, or of their own. Thoſe with the moſt capacious mouths, purſue almoſt every thing that has life, and often meet each other in fierce oppoſition, when the fiſh which has the wideſt throat comes off with victory, and devours its antagoniſt †.

Thus

* Willoughby, lib. i. cap. x. † Goldſmith, Nat. Hiſt. vol. vi.

Thus the rapacious fiſhes are different from the predatory kinds of terreſtrial animals; they are neither few in number, nor ſolitary in their habits. Their rapacity is not confined to a few ſpecies, one region of the ſea, or individual efforts. Almoſt the whole order is continually irritated by the cravings of an appetite, the ſtrength of which excites them to encounter every danger, and which, by its exceſs, often deſtroys that life which it was intended to prolong. Innumerable ſhoals of one ſpecies, purſue thoſe of another through vaſt tracts of the ocean, from the vicinity of the pole, down to the equator. It is thus that the cod purſues the whiting, which flies before it, from the banks of *Newfoundland*, to the ſouthern coaſts of *Spain*. Thus too the cachalot drives whole armies of herrings from the regions of the north, devouring, at every inſtant, thouſands in the rear. Hence, the life of every fiſh, from the ſmalleſt to the greateſt, is but a continued ſcene of rapine; and every quarter of the immenſe ocean, preſents one uniform picture of hoſtility, violence and invaſion.

In this unceaſing conflict, occaſioned by the voracity of the different kinds of fiſhes, the ſmaller tribes muſt have, long ſince, fallen victims to the avidity of the larger, had not Nature ſkilfully proportioned the means of their eſcape, their numbers, and their productive powers, to the extent and variety of the dangers, to which they are continually expoſed. To ſupply the conſtant waſte, occaſioned by their deſtruction in the unequal combat, they are not only more numerous and prolific, than the larger kinds; but, by a happy inſtinct are directed to ſeek for food and protection near the ſhore; where, from the ſhallowneſs of the water, their deſtroyers are unable to purſue them. Theſe, yeilding

to

to the ſtrong impulſe of hunger, become plunderers in their turn, and revenge the injuries committed on their kind, by deſtroying the ſpawn of the larger fiſhes, which they find floating upon the ſurface of the water *. Even there, however, they often meet with that violence which their own hoſtility merits; for the oyſter, the ſallop, and the muſcle, lie in ambuſh at the bottom, with their ſhells open; and, whatever little fiſh inadvertently comes into contact, they inſtantly cloſe their ſhells upon it, and, at their leiſure, devour it in the concealed manſions of a priſon, from which there is no poſſibility of eſcape.

In what manner digeſtion is carried on, to ſuch an amazing extent and rapidity, in the ſtomachs of fiſhes, no inquiries of naturaliſts have yet been able to aſcertain. If we were to judge from their ſubſtance or heat, we would be led to conclude, that the digeſtive powers of theſe animals are feeble and imperfect; whereas, they appear ſo far to exceed every thing that can be effected, either by trituration, the operation of heat, or of a diſſolving fluid, that a celebrated phyſician, after various experiments, has been of opinion, that none of theſe cauſes is equal to the effect †; and that the power of digeſtion, in the cold maw of fiſhes, is ſo great, as to overturn thoſe ſyſtems, that have attempted to account for it on theſe principles.

The powers of aſſimulation in fiſhes, ſeem to increaſe with the quantity of food with which they are ſupplied. A pike ſparingly fed, can be habituated to ſubſiſt on very little nouriſhment; if fully ſupplied, it acquires the power of devouring an hundred roaches in three days. The digeſting power of fiſhes, is as extraordinary, as their

* Goldſmith, Nat. Hiſt. vol. vi. † Dr. Hunter.

their appetite is voracious. The cod and ſturgeon will not only ſwallow, but diſſolve crabs, muſcles, lobſters, and every kind of ſhell fiſh, whoſe coverings are much harder than the coats of their ſtomachs. On diſſection, the maw is found to be a ſoft bag filled with ſhells; the calcareous earth of which, undoubtedly, ſupplies the animal with nouriſhment. From this fact it would appear, that fiſhes are ſupplied with a powerful ſolvent, hitherto undeſcribed, which enables them to convert the ſubſtances they ſwallow into a fluid, fitted for their peculiar ſupport.

Some exceptions to the extraordinary voracity of fiſhes, are produced by naturaliſts, which, if fully examined, will, perhaps, appear more apparent, than real. Some are ſaid to ſubſiſt on pure water alone; an aſſertion, which is ſuppoſed to be proved by numberleſs inſtances of their ſubſiſting, for ſeveral months, in ponds conſtructed of hewn ſtone, where they had been ſupplied with no food *. It is alleged too, that thoſe, which are carried from a diſtance to the markets of *London* and *Paris* in perforated veſſels, muſt ſubſiſt upon water alone.

The element of water, however, is ſeldom found pure and unmixed. The very epithets of ſalt, bitter and ſweet, imply a compoſition and mixture, perceptible even to the taſte. The particles of the earth upon which it runs, neceſſarily enter into it, and vitiate its purity. Theſe ſubſtances, together with myriads of animalcules with which it teems, may ſupply, for a while, a ſcanty ſubſiſtence, and ſupport the life of the moſt voracious animals.

In

* Rondelet. apud Will.

In the mean time, it will readily be allowed, that fiſhes, though for ever hungry and prowling, can endure the want of food for a long time. In them, habits ſeem to be formed by the circumſtances in which they are placed. Want produces abſtinence; from abundance they learn voracity. A pike, one of the moſt gluttonous of fiſhes, will live, and even thrive, in a pond where there is none but itſelf; and the gold and ſilver fiſhes, which we confine in glaſs vaſes, ſubſiſt, frequently for years, without any viſible ſupport but water. *Rondeletius* mentions one that was kept at his houſe, in this manner, for three years, which grew to ſuch a ſize, that the vaſe could ſcarcely contain it, nor could it be brought out at the ſame paſſage by which it was introduced into the veſſel *. It would appear, therefore, that, in certain ſituations, fiſhes are as remarkable for abſtinence, as, in others, they are diſtinguiſhed for voracity; and that Nature, in compaſſion to the want which they muſt often ſuffer, has indulged them with a power of accommodating their appetite to ſcarcity of food, as well as to abundance.

## Section IV.

### *Of the Generation, Fecundity, &c. of Fiſhes.*

The grand diviſion of fiſhes into the cetaceous, cartilaginous, and ſpinous, was formed by *Ariſtotle*, according to

* Hoc modo ſuaviſſima mea conjux, tres annos, piſcem domi aluit; ſicque educatus, in eam corporis molem accrevit, ut tandem nec vas eum capere, nec qua ingreſſus fuerat, eâdem exire poſſet. *Rondelet.*

to the three different modes of their generation. Among thoſe of the firſt order, fecundation is accomplifhed within the body of the female, by means of a *penis intrans*, as in terreſtrial animals. They are all viviparous; that is, the female, after having been fecundified by the male, and after a certain period of geſtation, produces a living and perfect animal.

The cartilaginous are alſo all, except ſome ſpecies of the ſturgeon, viviparous; and among this order too, fecundation ſeems to be performed within the body of the female, who conceives two or more large eggs, diſtinctly containing red and white, like thoſe of birds. In theſe eggs the fetus is formed; and, by the white of them, it is fed, while it is hatched within the body of the mother, without being excluded in the egg ſtate, as is the caſe in birds. In this ſtate, the eggs have been found in the belly of a dogfiſh, with the young completely formed, and of a very conſiderable ſize *. The number of theſe eggs lodged at one time in the uterus, is various, according to the ſpecies to which the animal belongs. One naturaliſt † obſerved in the belly of ‡ a dogfiſh, ſix that were arrived at their full ſize, beſides many others, in which the fetus was ſcarcely formed; another ſaw, in the *cornua uteri* of a torpedo, ſix eggs on one ſide, and eight upon the other.

The mode of generation that obtains among the viviparous or ſpinous fiſhes, is, from their ſituation and manner of life, involved in great obſcurity. It is generally ſuppoſed, that their eggs are not fecundified, till after their excluſion from the matrix of the female. They ſeem, indeed, amidſt their evolutions in the deep, to copulate;

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* Rains apud Willough. Lib. I. cap. ix. † Rondeletius.
‡ Franciſc. Redi. Galei Spinacis.

pulate; but, as the male is furniſhed with no external organs of generation, his junction with the female is only to emit his impregnating milt upon the eggs, as they fall from her body. For this purpoſe, it is ſaid, he purſues them along the ſtream, carefully impregnating them, one after another.

Theſe facts, however, are controverted by *Linnæus*, who maintains, that no fecundation can take place, except within the body of the female *, although the generation of frogs and lizards has always been regarded as an example of the contrary. In ſupport of his hypotheſis, he aſſerts that he obſerved, at ſpawning ſeaſon, every male pike ſurrounded by ſeveral females; and that, as ſoon as the milt was ejected by him, it was immediately ſwallowed by the females; a procedure which he had occaſion to notice in ſeveral other kinds of fiſh.

The experiments that have lately been made at *Berlin* by a ſkilful naturaliſt †, ſeem totally to overthrow this doctrine of *Linnæus*. It has been found, that of both ſalmon and trout, the roes, artificially extracted from the body of the female, were capable of being fecundified by an admixture with the milt of the male. Hence it is probable, that, though both the male and the female concur in the great work of impregnation, yet the act is performed without the body of the latter; and that the ſpawner ejects her eggs, while the milter ſprinkles them with ſperm.

The ſcience of ichthyology is ſtill in its infancy. Supported by few accurate obſervations, and ſtill fewer experiments, it has hitherto been regarded as a field for



* *Vide* Syſtema Naturæ ad locum.

† M. Jacobi.

theory, ſpeculation, and conjecture. Hence we are no ſooner free of one difficulty, than we are met by another equally perplexing and inſurmountable. It has long been a queſtion, among philoſophers, whether fiſhes are produced by ſpontaneous generation *. That they are, an ancient naturaliſt pretends to have proved by his own experiments and obſervations †. There is, ſays he, in the vicinity of *Piſa*, and ſurrounded, on every ſide, by hills, a place, into which the waters of no fountain, ſtream, or lake, ever flowed; a place, which no moiſture, except the rain from the clouds, ever watered. A few days before my arrival at this ſpot, a copious ſhower of rain had overflowed it with water, and nature herſelf had ſupplied it with fiſhes, among which vaſt numbers of carp were obſerved. The ſame thing, he adds, is ſeen in many pools in *France*, into which no ſtock, or original, of the many various fiſhes they contain, was ever placed.

Another philoſopher has adopted the ſame opinion concerning the ſpontaneous production of fiſh; becauſe, in ponds newly dug out, fiſhes have been obſerved during the firſt year; and, in ſucceeding ones, many other different kinds, although none had been originally tranſported thither ‡. It is a phenomenon in Nature, for which it is indeed difficult to account, but notwithſtanding an incontrovertible fact, that in ſtagnating pools occaſioned by the rain in *Bombay*, which have no communication with any river, or the ſea, fiſhes are generated, of which many perſons have eaten, and which, upon

* Willoughby, lib. I. cap. ix.

† Rondeletius de Piſcib. lib. I. cap. iv.

‡ Albertus magnus apud Geſnerum.

upon the drying of theſe ponds, die, and are corrupted *. But, however difficult theſe appearances may be to explain, or in whatever manner the fiſhes were introduced into theſe ponds, we muſt conclude, that they were originally produced from the eggs of animals of their own kind; becauſe the idea of ſpontaneous generation is repugnant to every maxim of ſound philoſophy †.

Fiſhes, in general, are male and female; the former poſſeſſing the *milt*, and the latter the *roe*. Some individuals of the cod and ſturgeon, are ſaid, indeed, to contain both. The ſpawn of the greater number of fiſhes is depoſited in the ſand or gravel; and, in that ſtate, it is probable, that the roe and milt are mixed together. Summer is the moſt common time for the ſpawning of fiſhes; becauſe, at that ſeaſon, the water is tepified by the beams of the ſun, and therefore better fitted for quickening the eggs into life. It is probably for this reaſon, that the herrings frequent the ſhores of Britain, at the ſpawning ſeaſon; there not being, in the unfathomable depths of the ocean, a ſufficient quantity of heat to hatch their eggs. When they have depoſited their burdens, they return to their former ſtations, and leave their infant progeny to ſhift for themſelves.

The ſpawn of different fiſhes continues in the ſtate of eggs, ſometimes for a longer, and ſometimes a ſhorter period. In general, however, this period is proportioned to the ſize of the animal. In the ſalmon kind, the young animal continues in the form of an egg, from the month of December till April; the young carp con-



* *Vide* Lind. on hot climates, Part II p 52.

† Linnæus, omne animal ex ovo.

tinues not, in that ſtate, for above three weeks; and the gold fiſh from *China*, is produced in a ſtill ſhorter period *.

When excluded from the egg, the young fiſhes all, at firſt, eſcape by their minuteneſs and agility. They perform all their motions with much greater celerity and eaſe, than grown and bulky fiſhes; and can make their way into ſhallow water, where they cannot eaſily be purſued. But, with all theſe advantages, not one, perhaps, of a thouſand, ſurvives the dangers of its youth. There is no inſtance, among the ſpinous fiſhes, of any thing reſembling parental affection: They all abandon their eggs to be hatched by the heat of the ſeaſon †; and, if they ever return to the ſpot where their young have begun the career of life, the male and female that gave them birth, forgetting all parental relation, become enemies as formidable as the moſt rapacious plunderers of the deep.

Though the fiſhes fall in millions by the rapacity of one another, yet they have other enemies than the animals of their own kind. Many of the quadrupeds frequent the ſhores, rivers, and lakes, where fiſh is almoſt their only food; and we have already had occaſion to remark, that a great proportion of the fowls reſide conſtantly on the ſea, where they either feed upon ſpawn, or become the mercileſs invaders of the ſmall fiſhes. Thouſands too of the human race, wander, in a ſavage ſtate, around the lakes and rivers, whence they derive a conſiderable portion of their ſuſtenance. And, among thoſe

* Goldſmith's Nat. Hiſt. Vol. VI.

† The *collis boviæ* is the only exception to this obſervation; it is ſaid to ſit upon its eggs at the bottom of the water.

thoſe nations, whom arts and agriculture have rendered leſs dependent on this precarious ſupport, ſuperſtition has come in the place of want, and given a new edge to their avidity for this ſpecies of food. From the invaſions, therefore, of terreſtrial animals, and from their own mutual rapacity, the annual conſumption of fiſhes is conſtant and immenſe; but the munificent Author of Nature has made a kind proviſion for his creatures, by the amazing fertility which he has conferred on this claſs of beings.

The fecundity of fiſh in general far ſurpaſſes that of any other animals; in ſome, it exceeds belief, for there are individuals among this claſs of the animal kingdom capable of producing, in one year, a greater number of their ſpecies than all the inhabitants of Great Britain. Nine millions of ova have been found in the ſpawn of a ſingle cod *; one million, three hundred, and fifty-ſeven thouſand, four hundred, have been taken from the belly of a flounder: The mackerel, carp, tench, and a variety of other ſpecies, are ſaid to poſſeſs a degree of fertility but little inferior †.

Such an aſtoniſhing progeny, were it allowed to arrive at maturity, and to add the whole of its number to the reſt of the family, would ſoon overſtock Nature; and even the ocean itſelf would not be able to contain, much leſs to provide for the half of its inhabitants. Of the ova ſpawned by theſe different fiſh, however, probably not one in an hundred ever becomes a full-grown animal: They are devoured by the leſſer fry that frequent the ſhores, by aquatic birds near the margin, and by the

* Dr. Lewenloch.

† *Vide* Farmer's calculations, Philoſophical Tranſactions, 1767.

the large fiſh in the deep water. Such as ſtill ſurvive, are ſufficient for ſupplying the ocean with inhabitants; and of theſe, notwithſtanding their own rapacity, and that of the aquatic fowls and terreſtrial animals, enough is left to relieve the wants of a great portion of the human race. Thus, two important purpoſes are anſwered in the economy of Nature by the extraordinary fecundity of fiſhes: it preſerves the ſpecies amidſt numberleſs enemies, and ſerves to furniſh the reſt with a ſuſtenance adapted to their nature *.

Among terreſtrial animals, there are various degrees of fertility, according to their chance of deſtruction, from the want of courage, bulk, or ſtrength: The largeſt are always leaſt productive, and the ſmaller are more prolific, in proportion as the dangers increaſe, to which they are expoſed †. The ſame obſervation may be extended to the inhabitants of the ocean: Among theſe, as the cetaceous fiſh reſemble quadrupeds in their habits and conformation, ſo they are diſtinguiſhed by a ſimilar degree of ſterility. All the whales, and even the cartilaginous fiſhes, are not, perhaps, ſuperior to terreſtrial animals in their powers of production. Among the hungry and heedleſs inhabitants of the ſea, they are diſtinguiſhed by finer organs and higher ſenſations. Their ſize and courage place them, in a great meaſure, beyond the reach of danger; they nurſe their young with tenderneſs and aſſiduity, and they protect them from injury with an obſtinate intrepidity little inferior to that of the lion or the eagle. Hence the number of their young is few, proportioned to the dangers to which they are expoſed: Amidſt

* Goldſmith's Nat. Hiſt. vol. VI.

† Buffon's Hiſt. generale et particulaire, tome 16.

midſt that ſecurity which they enjoy, and the eaſe with which they can repel the hoſtility of the inimical tribes, they run but little hazard of being deſtroyed by their rapacity.

## Section V.

### *Of the Growth, Longevity, and Dietical Uſes of Fiſh.*

As the dangers to which the progeny of all the ſpinous fiſhes, while in the form of ova, and in their naſcent ſtate, are innumerable, and ſurrounding them on every ſide, Nature has happily ordered, that they ſhould remain but a ſhort time in that defenceleſs condition. The period at which the different ſpecies arrive at their appointed ſize, is not exactly aſcertained; but the generality of naturaliſts agree in reckoning it extremely ſhort *. Ariſtotle, and Pliny who copied him, ſeem both to have committed a miſtake, when they aſſigned only two years for the life of the tunny †, a fiſh which approaches to to the ſize of a whale. This ſpecies had various different names aſſigned it, till it arrived at its fifth year, when it received the appellation of a whale; a circumſtance from which we muſt conclude, that the ancients in general entertained a very different idea of its longevity ‡. Of a ſimilar

* Rondeletius, de piſcibus.

† Vita Thynnis longiſſima biennio. Plinii Hiſt. Anim.

‡ During the firſt year, they were called Scordyla; the ſecond, Palamides; the third, Thynnis; the fourth, Oreyni; and the fifth, Cete.

ſimilar error, many of the moderns are guilty in aſſerting, that the common ſalmon arrives at its full growth in a year. Our moſt experienced fiſhers diſtinguiſh them alſo by different names, till they arrive at their ſixth year, when they are ſuppoſed to have reached their full ſize: Thoſe of the firſt year they call ſmelts; of the ſecond, ſprods; of the third, morts; of the fourth, fork-tails; of the fifth, half-fith; and of the ſixth, ſalmons *. It is probable, however, notwithſtanding the immenſe ſize at which many of them arrive, that fiſhes, in general, are of a quick growth, and that the period of their adoleſcence is ſmall, in proportion to that of their lives. There is another peculiarity attending the growth of fiſh; and that is, the cetaceous kinds, which are by far the largeſt, inhabit chiefly the colder regions of the ocean, adjoining the poles. The reverſe of this is the caſe with terreſtial animals, who always diminiſh in ſize as they recede from the heat; and by far the largeſt of them, the elephant, the camel, and rhinoceros, are only found in the warm or intratropical latitudes. It is probable, indeed, that the whales might prefer the more temperate regions of the ocean, and might even acquire a large ſize there; were they not compelled to avoid them by the frequent diſturbance given by ſhips, and to ſeek that tranquillity, of which they are fond, in the unhoſpital climes of the north †.

Hitherto, we have been examining fiſhes with regard to their external conformation, and have found them inferior to terreſtrial animals in their organization, and in the number of their enjoyments. We are now to contemplate

* *Vide* Willoughby, lib. i. cap. 10.

† Idem ibidem.

plate them in a more favourable point of view, and that is, in the extraordinary period of time during which they poſſeſs the humble exiſtence which Nature has aſſigned them. Their longevity is far ſuperior to that of other animals *. We have already ſeen what ample proviſion is made for ſupplying them with food, by multiplying the inhabitants of the ſea: They are, therefore, in little danger of periſhing from want; and there is reaſon to believe, that they are, in a great meaſure, exempted from diſeaſes.

Moſt of the diſorders incident to mankind ariſe from the changes and alterations incident to the atmoſphere; but fiſhes reſide in an element but little ſubject to change; theirs is an uniform exiſtence; their movements are without effort, and their life without labour. Their bones alſo, which are united by cartilages, admit of indefinite extenſion; and the different ſizes of animals of the ſame kind among fiſhes is very various. They ſtill keep growing; their bodies, inſtead of ſuffering the rigidity of age, which is the cauſe of natural decay in land animals, ſtill continue increaſing with freſh ſupplies; and as the body grows, the conduits of life furniſh their ſtores in greater abundance. How long a fiſh, that ſeems to have ſcarce any bounds put to its growth, continues to live, is not aſcertained †.

Some ſpecies of the German carp have been known to live an hundred years †; thoſe ſpecies, however, with which we are beſt acquainted, ſeem not to enjoy ſo great a degree of longevity. The ſalmon, we have remarked, takes only ſix years to reach its full ſize; if we



* Geſner de piſcibus. † *Vide* Bacon's works.

allow four or five times that ſpace for the period of its life, it will not exceed thirty years.

Different methods have been deviſed for aſcertaining the age of fiſhes, ſome of which will, perhaps, pretty accurately determine this matter. The ingenious Mr. *Hiddoſtroam*, a *Swede*, has attempted to compute their ages by the number of concentric circles obſerved in a tranſverſe ſection of the vertebræ of the back; and it has been found, that each circle, like that in the ſection of a tree, correſponds to a year of the animal's life. In confirmation of this fact, experiments have been made on different individuals of various ſizes, but of the ſame age, whoſe concentric circles have always been of an equal number; whereas a young fiſh differs from an older one of the ſame ſpecies, by having a ſmaller number of theſe circles. By this method of computation, ſeveral fiſh were found from fifteen to twenty years, but none gave indications of a greater age.

Another method of computing the age of fiſhes, practiſed by M. de *Buffon*, is by numbering the concentric circles upon their ſcales *; but as this requires a more minute examination, it is, of conſequence, liable to greater uncertainty. On examining the ſcale of a fiſh through a microſcope, it exhibits a number of circles, one within another, reſembling thoſe in the vertebræ of the back, and, like them, every circle repreſents a year of the fiſh's life. A ſcale of a carp, thus examined, announced the animal to be no leſs than an hundred years; a longevity leſs incredible, becauſe confirmed by the teſtimony of ſeveral different authors †, ſome of whom have aſſerted, that this fiſh lives twice that period.

The

* *Vide* Hiſt. gener. et part. † Geſner and Albertus.

The dietical uſes of fiſhes are to us the moſt important article of their hiſtory, a part that is happily free from that uncertainty and darkneſs in which many other circumſtances relating to their manners and economy are ſtill involved. All fiſh whatever, and particularly thoſe without the tropics, are capable of being converted into wholeſome food. Every *European* fiſh, while in ſeaſon, is nutritive; the various methods of preparing and dreſſing them are detailed by the Authors to whom that province belongs. Such diſquiſitions conſtitute the hiſtory of an art, but they are not the objects of ſcience.

Fiſhes, in general, when out of ſeaſon, are unwholeſome, and even pernicious; and this is more eſpecially the caſe with the oily kinds; ſuch as the herring, the mackerel, the eel and the ſalmon. So little is this fact attended to, that the eating of the latter of theſe fiſhes, at an improper ſeaſon, has been the immediate cauſe of an epidemic fever. Some of the fiſhes that frequent the ſhores of the *Weſt-Indian* iſlands, are ſaid to be poiſonous: that they are naturally ſo, however, may be juſtly queſtioned; though there can be no doubt of their becoming pernicious in certain circumſtances. If they feed upon copper-banks, their food may contain ſo great a quantity of the poiſon combined with that metal, as may render their fleſh noxious; and the ſame conſequence will enſue if they devour the ſeeds of ſome poiſonous plants that grow in theſe parts of the globe.

The improvement of the arts tends greatly to extend the dominion of man over the inferior animals; the art of navigation, in particular, may be ſaid to have completed his conqueſt of the ocean, and brought a vaſt ac-

ceſſion both to the fund of his ſubſiſtence and enjoyments, by the capture of ſo many animals whom Nature ſeemed to have placed beyond the reach of his power. A fleet of fiſhing veſſels, manned by a few thouſand *European* ſailors, is capable of taking a greater number of fiſh in a ſeaſon, than perhaps could be done by all the ſavages on the continent of *America*. But the ſuperſtitious regulations of the Romiſh Church has tended more than any other circumſtance, to enhance the value, and increaſe the quantity of this ſpecies of food. To ſupply the imaginary abſtinence of the devout or ſuperſtitious, large demands are annually made upon the ſea; and to make up for the deficiency of this precarious ſupply, ponds have been dug, and fiſh, like land animals, rendered domeſtic.

In the conſtruction of theſe ponds, it may be proper to obſerve, that, if intended for breeding, they ought to be of various depths, from ſix feet to ſix inches; for few fiſh will ſpawn in water of any conſiderable depth. Such pieces of water ought alſo to be partly filled with aquatic plants; becauſe theſe afford ſhelter and nouriſhment to different kinds of inſects, that contribute to feed the fiſhes: For a ſimilar reaſon, fiſh ponds ought to be ſurrounded with trees, that the inſects frequenting them may afford an additional ſupply for their ſubſiſtance. In arranging the fiſhes in theſe receptacles, attention ought to be paid to the different ſpecies that are introduced into the ſame pond. Carp and tench agree well together; but they frequently do not thrive when mixed with any other ſpecies. The perch is almoſt the only fiſh that can be ſafely entruſted in a ſheet of water frequented by the pike.

In

In populous countries, like *China* or *Holland*, where every article of food is in requeſt, and every ſpot of ground is turned to account, great attention is paid to the ſtructure and management of fiſh ponds: There experience has taught men to aſcertain the quantity of every kind of fiſh, which any given ſpace of water can ſupport. Ninety brace of carp, and forty of tench, may be ſupported in an acre of water; a greater number would languiſh and die. In tranſporting fiſh from rivers into ponds, it has been found that the young thrive much better after the operation, than the old; for at that period of life, they poſſeſs a power of more eaſily accommodating themſelves to any change in their ſituation.

In ſome parts of *Germany*, where the domeſtication of fiſh is practiced, the ponds are conſtructed in a ſuite, one adjoining another; and, by means of a communication between them, they can empty the water of one pond, together with the fiſh, into another. After this is accompliſhed, the empty one is frequently plowed, and ſown with barley: When the grain is in the ear, the water, with its inhabitants, are again admitted to feed upon the grain, and are thus more expeditiouſly fattened than by any other management. In all fiſh ponds, the milters are the preferable fiſh, for they become much fatter than the ſpawners.

Fiſh of different ſpecies, as well as terreſtrial animals, are found capable of producing an offſpring; but their croſs breeding is a very obſcure article of their hiſtory. Few ſpecies have hitherto been domeſticated, and on theſe, but a very ſmall number of well-atteſted experiments are known. A croſs breed is ſaid to be obtained between the carp and the bream, and between the carp and tench: That

That between the carp and tench was produced by mixing the milt of the former with the ſpawn of the latter; the offspring, which was examined by Mr. *Pennant*, bore a greater reſemblance to the male than the female parent *.

It is remarkable, that ſo few ſpecies of this claſs of the animal kingdom have been tranſlated from their primitive haunts, and made ſubſervient to man by domeſtication. Only three kinds have been tranſported from foreign parts into *Britain*; the carp, the tench, and the goldfiſh. Double that number are domeſticated with ſucceſs upon the continent; but even this, in all probability, is but few to what might eaſily be rendered ſubſervient to the ſame purpoſe, by the induſtry of man. There can at leaſt be entertained no doubt that thoſe domeſticated upon the continent would thrive equally in *Britain*.

The caprinus coruſius is found indigenous in many of the rivers in *England*, where it is called the rudd. It is reckoned a ſuperior fiſh to the carp in many reſpects, yet it has never been domeſticated in its native country, though reared with great advantage in the fiſh ponds of *Sweden*. The cobetus foſſilis is a fiſh unknown in this country; but is domeſticated, with profit, in the ponds at *Stockholm*, and might, with equal propriety, be tranſlated into thoſe of *Scotland*. In the ſame manner, the cobetus barbatula, which was introduced into *Sweden* by *Frederick* I. might be made an inhabitant of our artificial ponds. The ſalmo tymalis of *Linnæus*, known in *England* by the name of graylin, is one of the beſt fiſhes both for ſport and the table, and might eaſily be tranſported here from the ſtreams of *Derbyſhire*, its native reſidence.

* *Vide* Brit. Zool. Vol. III. claſs iv. p. 356.

reſidence. Both eels and charr might be rendered uſeful pond-fiſh; as neither are too delicate for tranſportation; and, from experiments already made, the certainty of their thriving is fully eſtabliſhed.

If the tranſlation of fiſh has not been often attempted, it certainly is not becauſe they are incapable of ſuſtaining various degrees of heat, and of living in different climates. The neceſſity of procuring a ſupply of food; of ſeeking a ſafe retreat for propagating their ſpecies, or a temperature of that element in which they live, ſuited to their conſtitutions, compels the fiſhes, as remarkably as terreſtrial animals, to make extenſive migrations from one part of the ſea to another. With regard, however, to this curious ſubject, we have but few facts upon which we can depend.

The fiſh, like land animals, are either ſolitary or gregarious: Of the former kind, trout, ſalmon, pike, &c. the migrations are probably in queſt of a proper place to depoſite their ſpawn. The ſalmon, for this purpoſe, leave the ſea, and mount the rivers in the beginning of winter, where they dig in the gravel, depoſite their burden, and again return. The trout likewiſe aſcends near the ſource of the rivulets at the ſeaſon, when they enter the ſmaller branches that run into the main ſtream, for the purpoſe of ſpawning. It is then they are often ſeen in ſmall rivulets upon the high grounds, in water ſo ſhallow as ſcarcely to cover their bodies.

Of the gregarious fiſhes that frequent freſh water, we know but little concerning their migrations. It is probable, that the perch and the minnow are ſtationary, and that they retire only to the margin of the river to depoſit their ſpawn. The fiſhes, moſt remarkably gregarious, are

are inhabitants of the ſea; ſuch as the cod, ling, herring, pilchard, and ſparling. The migrations of the herring are well known. In the months of June and July, it iſſues in vaſt ſhoals from the unexplored regions of the northern ocean; ſurrounds the *Britiſh* iſles, and enters the bays and arms of the ſea. Theſe fiſhes are known to take up their reſidence in ſome particular loch or creek for eight or ten years, and then to reſort to another for a ſimilar period. The tythe, the calfiſh, the cod, and whiting, have all their ſeaſons of migration. The laſt, in particular, are probably forced upon thoſe immenſe journeys from the coaſts of *America* to thoſe of *Spain* and *Africa*, to avoid the purſuit of the cod, and other rapacious invaders.

From theſe obſervations, it would appear, that fiſh of the ſame ſpecies are capable of living in very different quarters of the globe, and of enduring various degrees of heat and cold; a circumſtance which opens a vaſt field for the enterpriſe and ingenuity of man in tranſporting them, and rendering them ſubſervient to the purpoſes of domeſtication. It is impoſſible to determine to what length this operation may be carried, or to aſcertain how great an acceſſion might thus be made to the ſuſtenance of the human race.

# CHAPTER II.

## SECTION I.

### *Generic Characters of the Cetaceous Fishes.*

THE cetaceous fishes conſtitute the firſt order, according to the Ariſtotelian diviſion; and have obtained from him that name, on account of their enormous ſize, and their producing a perfect animal from *ſemen*, and not from *ova* *. Theſe animals, from the more perfect conformation of their organs, as well as their ſuperior bulk, are fully entitled to the firſt rank among the inhabitants of the ocean. Among the terreſtrial animals, we have ſeen ſome endowed with higher powers, and more various inſtincts, and thereby challenging a ſuperior rank among the kindred tribes. The ſame diſtinction obtains among the aquatic orders, where the whale, poſſeſſing the organization and many of the habits of quadrupeds, claims the firſt ſtation among his companions of the deep †.

This order contains the whales of all the various kinds, who want teeth; the cachalot, with teeth in the lower jaw;



* Willoughby, lib. ii. p. 26. † Goldſmith's Nat. Hiſt. vol. VI.

jaw; the dolphin, with teeth in both jaws; the porpeſſe; and the grampus. Such are the marks by which the different tribes of this diviſion are diſtinguiſhed from each other; but the moſt ſtriking and obvious character by which they are at once diſcriminated from all other animals, is their immenſe ſize. The teſtimony of all ancient writers concurs in aſcribing to them a bulk far ſurpaſſing the largeſt animal known upon the globe. In thoſe books which *Juba* wrote to the ſon of *Auguſtus Ceſar* concerning *Arabia*, whales of ſix hundred feet long, and three broad, are ſaid to have entered a river of that country *. *Pliny* himſelf vouches the extraordinary ſize of two hundred and forty feet in length, by eighteen in breadth; and *Nearchus* declares, that he ſaw on one of the iſlands oppoſite to the mouth of the *Euphrates*, a whale of an hundred and fifty cubits, caſt out upon the ſhore. *Arrian* †, *Strabo* ‡, and *Diodorus*, mention nations of ſavages bordering on the *Indian Ocean*, which built their houſes of the bones of whales caſt out by the ſea, uſing their jaws for door caſes; and we find from *Frobiſher*, that the ſame method of architecture was formerly practiſed by the inhabitants of *Greenland* §.

Many later writers give a ſimilar account of the magnitude of whales. Even within the arctic circle, they were formerly of a prodigious ſize, when their capture was leſs frequent, and the fiſh were allowed to grow. We know, by the accounts of travellers, that within the torrid zone, where they are unmoleſted, they are ſtill ſeen one hundred and ſixty feet in length ||. Thoſe at preſent taken in the *Greenland* ſeas, ſeldom exceed eighty or ninety

* Pliny lib. xxxii. cap. 1. † Liber viii. ‡ Liber xv.
§ *Vide* Second voyage, p. 18. || Adamſon's voyages, p. 174.

ty feet in length, and about twenty in breadth: Even thefe, however, muft appear enormous to the fpectator, and, when firft beheld rifing from the deep, muft have ftruck him with aftoniſhment and terror. Thofe who frequent the northern ocean, to whom the frequency of the ſight has rendered it lefs tremenduous, muft enjoy a magnificent ſpectacle in beholding ſuch an enormous animated maſs tumbling amidſt the waves, and darting through the water with incredible velocity! Such wonders does Nature preſent in an element where her operations are but partially known; perhaps ſhe has ſtill greater wonders concealed in the deep, which we have had no opportunities of exploring. The whales are obliged to ſhew themſelves upon the ſurface, in order to take breath: but who knows the ſize of thoſe animals that are fitted to remain for ever under water; and that have been increaſing in magnitude for centuries *.

Though we now ſee no whales two hundred, and two hundred and fifty feet, which we have good reaſon to believe was the caſe two centuries ago, ſtill the ſize of this order of beings is ſufficient to diſtinguiſh them from all the reſt of the animal kingdom. It is probable, indeed, from ſkeletons that have been found at different times, that there once exiſted terreſtrial animals of much greater bulk than are to be found at preſent. Creatures of ſuch an immenſe ſize muſt have required a proportionable extent of ground for ſubſiſtence; and by being rivals with the human race for large territory, they muſt have been deſtroyed in the conteſt. A ſimilar cauſe has



* The ſea-ſerpent, or kraken, is ſaid to be ſeveral miles in circumference, and to appear like a ſmall iſland. To believe all ſuch relations would be credulity; but to deny their poſſibility, would be preſumption. Goldſmith's Nat. Hiſt. vol. VI.

diminiſhed both the number and the ſize of the cetaceous tribes: Man had no ſooner completed his ſovereignty over the ocean by the invention of the compaſs, than theſe animals were ſo much thinned by continual capture or deſtruction, that they have never had time to arrive at that enormous bulk which the peaceable poſſeſſion of the ſea, in former ages, conferred *.

The external conformation of the fiſhes of this genus, no leſs than their ſize, ſerves to characteriſe them among the other inhabitants of the deep. They are covered with a dark-coloured cinereous ſkin: they are moved, commonly againſt the wind, and with vaſt rapidity, by means of a horizontal tail, aided by three fins; two pectoral, and one back fin; but in ſome ſpecies, the laſt is wanting. The head is commonly extremely large, in proportion to the ſize of the body, being in ſome equal to a third of the ſize of the fiſh. The animal is directed to its prey by two ſmall eyes, furniſhed with eyelids, and not ſuperior in ſize to thoſe of an ox. As the cetaceous tribes all breathe by means of lungs, they have no branchiæ nor external apparatus for that purpoſe †. In the middle of the head, there is one, ſometimes two orifices, through which they ſpout water to a vaſt height and with a great noiſe. With theſe orifices raiſed above the ſurface, the whales ſleep and breathe, gently moving their fins, to keep them poiſed upon the ſummit of the water ‡. When immerſed below the ſurface, or while devouring their food, water unavoidably ruſhes into the throat and lungs, and is, in this manner, ejected every time they riſe for a ſupply of air. If the animal be wounded, it ſpouts the air and water with a violence ſufficient

* *Vide* Britiſh Zoology, claſs iv. gen. 1.
† Ariſtot. Hiſt. Animal.
‡ Willough. lib. ii. cap. 1.

ſufficient to overſet a ſhip; and the noiſe it occaſions, is heard like the diſcharge of cannon, at the diſtance of ſome miles.

Animals of ſuch enormous ſtrength and magnitude, we might imagine, would ſpread terror and devaſtation all around them, and make an indiſcriminate ſlaughter of the inferior tribes. No creature, however, is leſs voracious than the common whale: Almoſt no animal ſubſtance is ever found in its ſtomach; it feeds, as ſome allege, upon different inſects that float on the ſurface; according to others, upon the *medufa* or ſea-blubber *. Its food, we are certain, muſt be extremely minute, for the capacity of its throat does not exceed four inches, a ſize beyond all proportion, ſmaller than that of other fiſh.

The ſmall quantity of food that ſuffices the whale, may juſtly ſurpriſe us, when we conſider their ſize, and the numbers of theſe animals that often herd together. Had their voracity been proportioned to their bulk and numbers, the ocean itſelf would hardly have afforded a ſufficient ſupply. The inſects upon which they feed, are black, and about the ſize of a bean: They are of a round form, like ſnails in their ſhells, and are ſeen floating in cluſters together upon the waves. Theſe, the whale ſucks up in great numbers, and bruiſes them with the barbs or pipes with which its mouth is internally covered †. Nourithed with this food, it becomes the fatteſt of all animals, whether terreſtrial or aquatic.

To a ſlender appetite, the whale adds peaceable and harmleſs manners: it purſues no other fiſh, but leads an eaſy and indolent life on the boſom of the waves, and is inoffenſive,

* *Vide* Lin. Syſtema Nat. † Goldſmith's Nat. Hiſt.

inoffenſive, proportioned to its ability to do miſchief. Among land-animals, we have had occaſion to obſerve, that ſovereignty does not always follow ſtrength or ſize *: The elephant and camel fly before the tyger and the lion; while the eagle poſſeſſes a decided ſuperiority over the vulture and the oſtrich. The ſame law obtains among the inhabitants of the ocean; where the whale, if he holds the ſceptre, holds it by a precarious tenure, for it may eaſily be wreſted from him by his ſubjects. There is a ſtrong analogy between his manners and thoſe of the elephant: Both are the ſtrongeſt and largeſt animals in their reſpective elements; neither offers injury; and each is terrible when provoked to reſentment.

But theſe peaceable and innoxious habits do not equally belong to the whole of the cetaceous order: The finniſh differs from the great whale in this reſpect; it ſubſiſts chiefly upon herring, and is often ſeen driving vaſt ſhoals of them before it. Thoſe of the cachalot tribe are ſtill more voracious, and commit greater depredations: They are furniſhed with teeth both in the upper and lower jaw; their throat, though inferior in capacity to that of the cartilaginous fiſhes, is much larger than in the common whale; and theſe powers of deglutition were probably conferred to gratify the cravings of an appetite proportionably more voracious. It is ſaid, that the fiſhes of this genus are poſſeſſed of a courage, that often proves fatal even to the animals of their own order: they purſue and terrify the porpeſſes to ſuch a degree, that they often drive them aſhore †.

The common whale, whatever honours vulgar prejudices may have conferred upon it, has no pretenſions to the

* *Vide* Buffon, Hiſt. gen. et part. † *Vide* Lin. Syſtem. Naturæ.

the ſovereignty of the ocean: On the contrary, as it is a peaceable and inoffenſive animal, it has many enemies diſpoſed to take advantage of its diſpoſition, and inaptitude for combat *. There is a ſmall animal of the teſtaceous kind, called the whale-louſe, that ſticks to its body, as we ſee ſhells ſtick to the foul bottom of a ſhip. This creature inſinuates itſelf chiefly under the fins; and, in defiance of all the efforts of the whale, it ſtill keeps its hold, and lives upon the fat, which it is provided with inſtruments to extract. The fiſhermen, however, often witneſs the encounters of the whale with a much more terrible enemy. At the ſight of the ſword-fiſh, this largeſt of animals is ſeen agitated in an extraordinary manner, and leaping from the water as if with fear. Wherever it appears, the whale perceives it at a diſtance, and flies from it in the oppoſite direction. The whale has no inſtrument of defence except the tail: with that it endeavours to ſtrike the enemy; and a ſingle blow taking place, would effectually deſtroy the adverſary: But the ſword-fiſh is as active as the other is ſtrong, and eaſily avoids the ſtroke; then bounding into the air, it falls upon its ſubjacent enemy, and endeavours, not to pierce with its pointed beak, but to cut with its edges. The ſea all about is ſeen dyed with blood, proceeding from the wounds of the whale; while the enormous animal vainly endeavours to reach its invader, and ſtrikes with its tail againſt the ſurface of the water, making a report at each blow louder than the noiſe of a cannon †.

A ſtill more fatal enemy of the whale, is an animal of its own order, called by the fiſhermen of *New England* the *killer*. Of ferocious habits, and furniſhed with ſtrong ſharp

* Goldſmith. † Anderſon's Dictionary of Commerce.

ſharp teeth, theſe animals when they ſurround a whale ſeldom allow it to come off with life. They tear and mangle its fleſh on all ſides, till fatigued with fighting, and overcome with wounds, it falls a prey at laſt to their fury; and after it expires, the tongue is extracted, the only part which they devour.

By the conſtant hoſtilities of theſe various animals, the race of whales has probably been gradually diminiſhing in number for ſeveral ages *. From the largeneſs of their ſize they cannot eaſily be concealed from their deſtroyers; and as they are diſtinguiſhed by ſterility among the finny tribes, their deſtruction cannot ſoon be repaired: But of all the cauſes of the waſte and diminution of this order of fiſhes, the interference of man has operated by far the moſt powerfully. His hoſtilities has been incomparably more fatal than thoſe of all the reſt of their enemies; and a greater number is probably deſtroyed in a ſeaſon by the ingenuity of the fiſhermen, than is devoured by the rapacious animals in an age.

The inhoſpitable ſhores of *Spitzbergen* were found to be the great reſort of the whales; and for more than three centuries, notwithſtanding the coldneſs of the climate, and the terrors of the icy ſea, a great number of *European* ſhips have annually frequented thoſe dreary abodes, and at length thinned the number of their inhabitants.

The whale fiſhery was carried on, for the ſake of the oil, long before the uſe of whale bone was diſcovered †. The ſubſtance which has obtained that name, adheres to the upper jaw; and is formed of thin parallel laminæ, ſome of the longeſt four yards in length. Of theſe there are

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* *Vide* Brit. Zoology, Claſs. iv. Genus. 1.

† *Vide* Anderſon's Dict. vol. i. p. 442.

are about ſeven hundred in all : about two thirds of that number are of a length fit for uſe, the reſt being too ſhort*. The oil is extracted from different parts of the body ; the tongue alone of ſome fiſh yielding from five to ſix barrels.

As early as the beginning of the fourteenth century, the *Biſcayneers* were in poſſeſſion of a very conſiderable trade to the coaſt of *Greenland :* They long enjoyed the profits of a lucrative traffic in train oil, and whale-bone, before the *Engliſh* attempted to obtain any ſhare of that commerce. What probably firſt gave them an idea of the advantages to be reaped from it, was the accident of one of their ſhips bringing a cargo of whale-bone and train-oil from the bay of St *Laurence*, part of the burden of two large *Biſcayan* ſhips that had been wrecked there about the year fifteen hundred and ninety-four †.

A few years after that period, the town of *Hull* had the honour of firſt attempting that profitable branch of trade. At preſent it ſeems to be on the decline, the number of fiſh being greatly reduced by their conſtant capture for ſuch a vaſt length of time. It is now ſaid that the fiſhers, from a defect of whales, apply themſelves to ſeal fiſhery, from which animals they alſo extract an oil, and turn the ſkins to good account. This trade however will not probably be of any long continuance, for theſe ſhy and timid creatures will ſoon be induced to quit thoſe ſhores by being perpetually harraſſed. We are informed too, that the natives of *Greenland* already begin to ſuffer from the ſcarcity of ſeals in their ſeas. The fleſh of theſe



* Britiſh Zoology, *ubi ſupra.*

† Hackluyt. Vol. iii. p. 194.

animals conſtitutes their principal ſubſiſtence; and ſhould they be at laſt extirpated, or deſert the coaſt, that miſerable people would be in danger of periſhing through want*.

Before the year 1598, the whale ſeems never to have been taken on our coaſts but when it was accidentally driven a-ſhore†. It was then deemed a royal fiſh, and the king and queen divided the ſpoil between them; the king aſſerting his right to the head, and her majeſty by prerogative entitled to the *tail*‡. A total revolution in the faſhion of eatables, and the great quantity of theſe fiſh that are now imported, has rendered this prerogative of royalty of leſs importance, and even ludicrous: formerly however the whale as well as the porpoiſe, and dolphin, was probably a diſh ſerved at the royal board; and from its magnitude it muſt have held a very reſpectable ſtation there. Such dainties continued in vogue ſo late as the reign of *Henry* VIII.; for, in a houſehold book of that prince§, it is ordered, that if a porpoiſe ſhould be too big for a horſe load, allowance ſhould be made to the purveyor. Even in the reign of Queen *Elizabeth*, we find directions for the dreſſing and ſerving up of the dolphin with porpoiſe ſauce; a compoſition of vinegar, crumbs of bread, and ſugar‖.

The fleſh of the whale has always made a part of the food of ſome ſavage nations. The natives of *Greenland* as well as the barbarous tribes that inhabit the vicinity of the ſouth pole, eat the fleſh prepared in various ways, and drink the oil, which is with them a firſt rate delicacy. The finding of a dead whale is an adventure conſidered among

* Britiſh Zoology, Claſs iv. Genus 1.

† Britiſh Zoology, *idem ibidem.*

‡ Blackſtone, Comm. i. c. 4. § Archæologia, Vol. iii.

‖ Gaij. Opuſcula 116.

among the moſt fortunate circumſtances of their wretched lives. They make their abode beſide it; and ſeldom remove till they have left nothing but the bones*. In the days of *Willoughby*, the eating whale was growing into diſuſe in England †; and at preſent the *Dutch* ſailors, as well as our own, will not taſte it except in caſes of urgent neceſſity: it is ſaid, however, that the *French* ſeamen frequently dreſs and uſe it as their ordinary food at ſea. The wretched inhabitants of the iſland of *Feroe*, who live one half of the year on ſalted gulls, are alſo, we are told, very fond of ſalted whales fleſh: the fat of the head, after being well ſeaſoned, they hang up in the chimney, and eat like bacon ‡.

The internal ſtructure of the whale we have already remarked, reſembles almoſt in every reſpect that of quadrupeds: Like them they poſſeſs lungs, a bilocular heart, a diaphragm and urinary bladder. The preciſe ſhape and ſituation of the viſcera of theſe animals is indeed far from being ſo exactly aſcertained as might have been expected, from the frequent opportunity there is afforded of examining them. In thoſe parts where they are caught in greateſt abundance, the ſailors are not very curious in inquiring into the ſtructure of the parts; and few anatomiſts care to undertake a taſk, where the operator, inſtead of ſeparating with a lancet muſt cut his way with an ax ||. It is therefore not yet known whether the whale has not one of its bowels entirely adapted for the reception of air, in order to ſupply it with that fluid, when it is obliged to continue longer than uſual below



* Goldſmith's Nat. Hiſt.

† *Duram habent carnem cetacea omnia; quamobrem ipſis ſale conditis fere ſic utimur.* Liber. ii. cap. 1.

‡ Jacobſon's Hiſt. of Feroe. || Goldſmith's Nat. Hiſt.

the ſurface of the water. We are certain, that there is no ſuch receptacle for air among the viſcera of terreſtrial animals: The analogy however, is not here ſo ſtrong as to juſtify us in denying the whale a particular proviſion of this nature, which the ſailors aſſert that they have diſcovered, and which the neceſſities of the animal ſeem to require.

As the cetaceous fiſhes reſemble terreſtrial animals in their conformation, ſo they are alſo diſtinguiſhed by ſimilar appetites and manners: Among them the act of copulation is ſaid to be performed *more humano*, and the female once in two years feels the acceſs of deſire. In the inferior tribes of fiſh we can diſcern hardly any thing like pairing between the males and females, and have no veſtiges of conjugal fidelity. The mutual attachment of the whales, however, exceeds whatever we are told of the conſtancy of birds.

Whenever a pair of whales are attacked by the fiſhers, they mutually aſſiſt, it is aſſerted, in the defence of each other; and when one is wounded the other ſtill attends lending every aid in its power; and no motives of fear or ſelf preſervation can urge it to deſert its aſſociate. An inſtance is recorded * of one, which, after maintaining an obſtinate conflict in defence of its companion, that had been ſtruck with a harpoon, and on ſeeing it expire under the wounds it had received, ſtretched itſelf upon the dying fiſh and yielded up its breath at the ſame inſtant.

The period of geſtation among the cetaceous fiſhes is ſaid to be nine or ten months; the female commonly produces one, and never above two young. During the time of her pregnancy, and particularly at the birth of her

* Anderſon's Dict. Com.

her offspring, ſhe is uncommonly fat. The embryo, it is ſaid, when firſt perceptible, is about ſeventeen inches long; and the cub when excluded, is of a black colour, and ten feet in length *. The two breaſts of the whale are hid within the belly; but when ſhe ſuckles her young, ſhe can produce them at pleaſure, when they are protuberant about two feet before her body. The teats reſemble thoſe of a cow; while the colour of the breaſts, in ſome is white, in others ſpeckled; in all, they are filled with a large quantity of milk reſembling that of land animals.

From what has been ſaid concerning the procreation of whales, it appears, that theſe animals, in fecundity, are far inferior to the reſt of the inhabitants of the deep. Nothing, however, can exceed their care and tenderneſs for their offspring when produced. The female whale carries her cub with her wherever ſhe goes; and when purſued by the fiſhermen ſhe keeps it ſupported between her fins. Even when wounded, ſhe ſtill claſps her young one; and when forced to plunge into the deep to avoid the ſtrokes of her purſuers ſhe carries it down along with her; but riſes ſooner than uſual, to allow it time for reſpiration.

In defence of her young, the whale is ſaid to diſplay a fierceneſs and courage far beyond what could be expected from an animal, ſo gentle and inoffenſive in its nature. *Waller* † deſcribes the conduct of a whale and her cub, when ſurrounded in an arm of the ſea, in a manner which ſtrongly diſplays the maternal tenderneſs of theſe animals. Being deſerted by the tide, they were incloſed on

* *Vide* Goldſmith's Nat. Hiſt. Vol. 6.

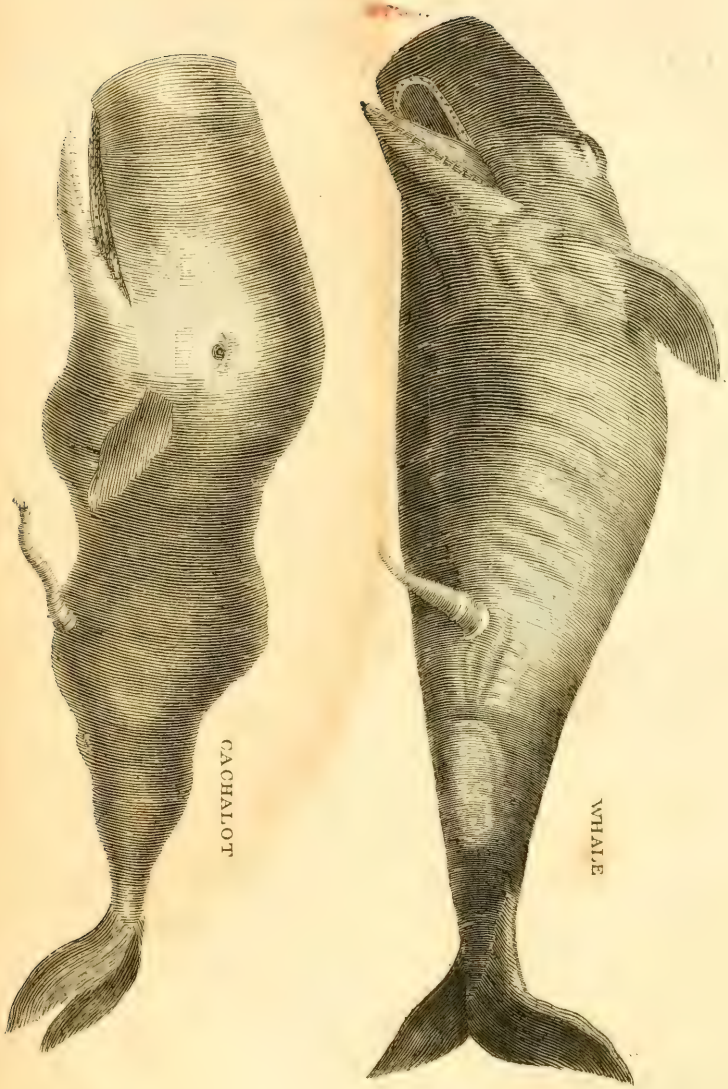
† *Vide* his Poem of the Summer iſlands.

on every ſide ; and the people from the ſhore obſerving that they had no means left of eſcape, poured down upon them in boats, armed with ſuch weapons as the urgent occaſion offered. After ſeveral ineffectual attempts to eſcape, the mother at laſt, by her ſuperior ſtrength, forced herſelf over the ſhallow into deep water : But though in ſafety herſelf, ſhe could not bear the danger that awaited her young one ; ſhe therefore ruſhed in once more where the ſmaller animal was incloſed, and reſolved, when ſhe could not protect, at leaſt to ſhare its danger. Happily for the ſafety of theſe animals, the rapid inſet of the tide ſoon enabled both to eſcape from their enemies, though not till they had received many wounds, and tinged the ſea all around with their blood.

It is, however, but for a ſhort period that the young whales ſtand in need of this parental aſſiſtance : Their growth is ſo remarkably rapid, that it may occaſion ſome doubt concerning the accounts that are given of their extraordinary longevity. The cubs continue at the breaſt, of the mother only for a year, during which period they attain to a conſiderable ſize, and are called *ſhort-heads* by the ſailors. The mother, at the end of that period, is extremely lean and emaciated, while her cub is ſo large and fat, that it frequently yields above fifty barrels of blubber. The next year after they have left the breaſt, they are called *ſtunts* ; becauſe they decreaſe in their fatneſs, and yield ſcarcely an half of the produce that is obtained from them when ſuckling. After two years the young whales are called *ſkull fiſh* ; and though for a while they continue of an inferior ſize, there is no mark by which their age can be aſcertained.

Though the whales are gregareous animals, yet every individual

Plate I.



CACHALOT

WHALE

individual propagates only with thoſe of its own kind; and without mixture of breed, they tranſmit an unpolluted race to poſterity. When they are ſeen in ſhoals of different kinds together, or making their migrations in large companies from one ocean to another, their object probably is ſecurity and mutual defence. Hardly any inſtinct leſs powerful than that of ſelf preſervation, from the attacks of ſmaller but more powerful fiſhes, could induce them to an union by which the ſcarcity of food muſt be ſo greatly increaſed.

## Section II.

### *The Common Whale*.*

This is the largeſt animal known. In the north ſea where it is moſt frequently taken, it meaſures from ninety to an hundred feet in length; and there is reaſon to believe that before the fiſhery had committed ſuch vaſt depredations, there were many of this ſpecies ſeen of a far ſuperior ſize †. In the warmer latitudes where they are leſs frequently taken, and conſequently have time to gain their full ſize, they are ſtill ſeen of the immenſe ſize of an hundred and ſixty feet; a circumſtance which ſeems to beſtow credibility upon the relations of ancient writers.

Though

* Balena, Rondelet. Willough. Ichth. La Baleine ordinaire, Briſſon.

† Britiſh Zool. Claſs iv. Gen. 1.

Though the ancients were acquainted with this ſpecies of whale, yet it does not appear that they knew its uſes, or practiſed the fiſhing of it. Ariſtotle has deſcribed it by the name of the bearded whale, from thoſe hairs or ſtrainers that ſurround the mouth to prevent the eſcape of its food, when the animal diſcharges the water from its mouth*. Pliny has given it the name of *Muſculus*, probably for the ſame reaſon.

It has already been remarked, that the food of this ſpecies is the meduſa or ſea-blubber; and it is probably the neceſſity of procuring this food that confines the animal in its reſidence to the artic circle. Few of them are ever ſeen ſo far ſouth as the *Britiſh* ſhores, though the ancients mention a large kind that obtained its name, from frequenting our coaſts †.

The head of the common whale is equal to one third of the ſize of its body: The fiſtulæ, or two orifices for ſpouting out the water are placed in the middle ‡. This ſpecies has no teeth: in their room are ſituated the black horny laminæ called whale bone, ſo long uſed in the ladies ſtays, in the conſtruction of umbrellas, and for various other purpoſes. Theſe laminæ give off a part of their ſubſtance which conſtitutes thoſe briſtles that ſurround the mouth, the ſuppoſed uſe of which has already been deſcribed. Cloſely confined by theſe briſtles lies the tongue, the tendereſt part of the animal, which was formerly ſalted up as a great delicacy §: It is now extracted only for the ſake of the oil; of which it contains no leſs than ſix barrels.

About

* Μυσιπητος Hiſt. anim. Lib. iii. cap. 12.

† *Quanto Delphinis Balæna Britannica major.* Pliny, Sat. 2.

‡ Britiſh Zoology.

§ Rondelet. apud Willough. p. 37.

About four yards diſtant from each other appear the eyes, externally not larger than thoſe of an ox, but conſtituting a pretty large ball within. This picturesque viſage is rendered tremenduous by the large opening of the mouth, which, when the jaws are extended, is no leſs than eighteen feet wide*. On the back of this animal there is no fin: but the two lateral ones are exceedingly large; and with them, as we have ſeen, it ſupports its young. The tail is broad, ſemilunar and horizontal; it is of ſuch vaſt ſtrength, that by a ſtroke of it upon the ſurface, the water is ſo much agitated, as to overſet a boat if it is near. The penis is included in a ſtrong ſheath, and is ſeven feet in length †.

The colour of whales varies very much; the back being in ſome red, and the belly generally white. Some are marbled with black and white, while others are entirely black, and ſome white. Their ſkin is ſmooth and ſlippery, and their colours in the water are extremely beautiful. In the belly of one deſcribed by *Rondeletius* there was found no kind of fiſh, only a ſort of mucus, foam, water, and ſea weed.

## *The Fin Fiſh* ‡.

This ſpecies is diſtinguiſhed from the common whale by the fin upon the back, placed low, and near the tail §. It is ſometimes found in the *Britiſh*, but is more frequent in thoſe tracts of the northern ocean, where the



* Idem ubi ſupra. † Britiſh Zool.

‡ Le Gibbar. Briſſon. Balæna Phyſalus. Linnæus.

§ Britiſh Zool.

whale fiſhery is carried on. It is, however, a booty which the fiſhermen ſeldom chooſe to purſue: The whale-bone adhering to its upper jaw is ſhort and knotty, and therefore of very little value: The blubber alſo yielded by this ſpecies is very inconſiderable in quantity; and theſe circumſtances, added to its extreme fierceneſs and agility, render the capture both difficult and dangerous; hence our ſeamen generally neglect it.

But meagre as this animal may ſeem to thoſe whoſe object is the procuring of oil, it is held in great eſteem by the miſerable *Greenlanders*; for its fleſh affords them a food which to men ſo poorly ſupplied is very agreeable.

This fiſh is generally of the ſame length with the common whale, but of a much more ſlender conformation. The lips are brown like a twiſted rope: The ſpout-hole is as it were ſplit in the top of its head, through which it blows water with much more violence, and to a greater height, than the common kind. The fiſhers are not fond of ſeeing it; for on its appearance the others retire from thoſe ſeas*. It is impoſſible to determine whether this ſpecies be the ſame with the *Phyſalos* and *Phyſeter* of the ancient writers, ſo vague are the terms in which they ſpeak of that fiſh †. If that particular name was aſſigned it from its faculty of ſpouting water, or blowing, the habit is not peculiar to any one ſpecies, but common to all the whale kind. It would appear from the name given it by *Linnæus*, that he believed this to be the animal ſpoken of by theſe writers. *Rondeletius* and *Geſner* have been of the ſame opinion; but the deſcription the firſt of theſe writers has given of this animal is in many reſpects

* Britiſh Zool.

† *Vide* Oppian Halieut, L. 1. l. 368. Oelian Hiſt. anim. and Plin. lib. ix. c. 5.

reſpects erroneous; of this nature certainly is the aſſigning it ſharp ſerrated teeth*. There are ſeven different kinds of the whale properly ſo called; five of theſe are enumerated among the *Britiſh* fiſhes. The common whale, the fin-fiſh above deſcribed, the pike headed whale, the round lipped, and the beaked. All theſe differ from each other in ſize and figure, as their names imply: Their manner of living is alſo ſomewhat different, the laſt deſcribed being more active and fierce than the reſt. None of them have a large ſwallow, when compared with other kinds of fiſhes; none of them accordingly are very voracious; and if compared to the cachalot, that enormous tyrant of the deep, their manners will appear harmleſs and gentle.

### *The Narwhal, or Sea-Unicorn*†.

THE narwhal is about ſixty feet long, of a more ſlender make than the common *Greenland* whale; and its fat is in leſs abundance. It inhabits the ſeas of *Iceland* and *Greenland*, and is ſeen in the ſame northerly regions with the reſt of the cetaceous tribes ‡. Nature has, however, diſtinguiſhed it from every other inhabitant of the deep, by that formidable weapon in the form of a tooth, which projects from its upper jaw. Amongſt all that variety of armour which ſhe has conferred upon her different tribes in the animal kingdom, ſhe has contrived no inſtrument of deſtruction ſo dreadful as the horn of the narwhal.



* Rondelet. apud Willough. cap. iv. page 41.

† Monoceros, Willough. page 42.

‡ *Vide* Bartholin. apud Willough. page 42.

It ſeems yet doubtful whether this extraordinary weapon of this fiſh grows naturally ſingle or double in the animal. There is a ſkull at preſent in the Stadthouſe of *Amſterdam*, which is armed with two of theſe teeth, which demonſtrates, that in ſome ſubjects at leaſt, this inſtrument is double*: But thoſe which are taken with one tooth, give no ſort of indication of having been deprived of the other by any accident: there appears no ſocket, nor any remains of a ſecond tooth in the oppoſite jaw; all there is plain and even.

This extraordinary inſtrument generally ſprings from the upper jaw on the left ſide; into the ſocket of which it reaches a foot and an half. It is ſtriated, and twiſted in ſpires, as we ſometimes ſee a bar of iron; its length is from ſeven to eight feet, and of the thickneſs of a man's arm: It is of a white colour, harder and heavier than ivory†. From the ſize of this weapon, moſt naturaliſts conſider it as an horn, rather than a tooth; but it reſembles in every reſpect the tuſks of a boar, or an elephant; it riſes like them, from a ſocket in the jaw; it is of the ſame ſtrong ſubſtance, and poſſeſſes the ſame ſolidity. *Willoughby* regards it as the only real example of an unicorn afforded by nature; and after a minute examination of all the ſubſtances that are impoſed upon the public for the horns of the unicorn, he pronounces them impoſitions on the credulity of mankind‡.

This naturaliſt had the greater merit in making a diſcovery of this nature, becauſe in his time the capture of whales was not very frequent, and the means of detec-

tion

* Goldſmith's Nat. Hiſt. vol. 6.

† Idem ibidem.

‡ *Vide* Ichthyol. lib. ii. p. 43.

tion were proportionably few in number. The tooth of the narwhal about a century ago was univerſally aſcribed to ſome land animal: it had often been dug up among foſſil ſubſtances, and from that circumſtance it was naturally beſtowed upon a terreſtrial owner. *Pliny* had long ago deſcribed an animal reſembling a horſe, with a ſingle horn ſpringing from the middle of its forehead *: Upon this animal, which a farther knowledge of nature has proved to be fictitious, the tooth of the narwhal was unanimouſly conferred; and the finding of ſo precious a remain, was conſidered as a fortunate incident, that afforded a ſtrong teſtimony of the veracity of that hiſtorian.

But it was not the curioſity of mankind alone, nor the rareneſs of the object, and the ſingularity of its form, that brought the narwhal's tooth into ſuch high repute in the different countries of *Europe*. A medicine was prepared from it, which was long given out by the quacks as an infallible ſpecific againſt poiſon, and malignant fevers †. At length, however, theſe frauds were detected and expoſed by one of the privy counſellors ‡ who had a concern in the whale fiſhery, and received by the return of his own veſſels a number of thoſe teeth, ſome of which were of the enormous length of three yards.

The error of ſuppoſing this armour of the narwhal a horn, has led ſome writers to ſuppoſe, that as among quadrupeds the female was often found without horns, ſo theſe inſtruments of defence were only to be found in the male. This, however, has often been contradicted by actual experience; both ſexes are found armed in this manner;

* Hiſtor. Natural.

† T. Bartholin. Act. Med. An. 1673.

‡ Henry Muller.

manner; and in all the varieties of the horn, whether wreathed or ſmooth, bended or ſtraight, it is uniformly ſtrong, ſharp, and deeply fixed. There can be no doubt, but that an inſtrument of this nature is intended for the defence of the animal on which it is beſtowed. It is thus that the narwhal uſes it; whenever it is urged to employ this terrible inſtrument, it drives directly forward againſt its enemy, and pierces him through.

But notwithſtanding this implement of war, and its amazing velocity and ſtrength, the narwhal is one of the moſt harmleſs and peaceable inhabitants of the ocean. It wants teeth for chewing, and a throat for ſwallowing any bulky prey: Of conſequence it commits hoſtility againſt no animal; but is conſtantly ſeen ſporting inoffenſively among the great monſters of the deep, never attempting to injure any of them. It is called by the *Greenlanders* the forerunner of the whale; for wherever it is ſeen, that fiſh ſeldom fails ſoon to appear. The manners of theſe two ſpecies nearly reſemble each other; the food of both is thoſe inſects which we have already deſcribed; and both are peaceable and innocent, though qualified by their ſtrength or their arms to ſpread general deſtruction *.

So little does this fiſh avail itſelf of theſe implements with which nature has provided it, that they appear rather an impediment, than a means of defence. It is at no pains to keep them in repair for action; but on the contrary, the tooth is conſtantly ſeen covered with weeds, ſlime, and all the filth of the ſea. In one inſtance they evidently operate to the deſtruction of the owners; for the narwhals being gregarious animals, they are no ſooner

* Goldſmith's Nat. Hiſt.

ſooner attacked by a fiſhing veſſel, than they croud together in ſuch a manner, that they are mutually embarraſſed by their tuſks, and are prevented from ſinking to the bottom. In this ſituation the harpooners ſeldom fail of ſtriking one or two of thoſe that are longeſt detained upon the ſurface of the water; and the quantity of the oil which they produce, renders their capture an object of very conſiderable emolument.

## Section III.

### Gen. III. *The Cachalot.*

The fiſhes of this genus are not of ſuch an enormous ſize as thoſe laſt deſcribed: They are, when full grown, from fifty to ſixty feet long, and ſixteen feet in thickneſs. Their heads are ſtill more diſproportioned to the ſize of the body, than that of the common whale: in the latter animal it is equal to a third of the body; in the former it conſtitutes an half. The cachalots are diſtinguiſhed from all the other cetaceous tribes, by having ſharp arcuated teeth in the lower jaw: Their bodies being more ſlender, they are more active than the *Greenland* whale; are capable of remaining longer at the bottom; and yield a ſmaller quantity of oil. The tongue is commonly ſmall, but the mouth and throat are ſo capacious that the animal could eaſily ſwallow an ox*. The teeth are about ſeven inches long, exceedingly thick and hard; they enter, when the mouth is ſhut, into a number of cavities in the upper jaw prepared for their reception†.

This

* Goldſmith's Nat. Hiſt.

† Britiſh Zool. Claſs iv. Gen. 2.

This formidable conformation of the mouth and throat ſeems to indicate an extraordinary degree of voracity in theſe animals. The hiſtory of the cachalot correſponds to theſe appearances: for while the ſtomach of the whale is ſeen to contain hardly any thing but froth, that of the cachalot is crammed with a variety of different kinds of fiſhes; ſome half digeſted, others whole; ſome ſmall, others eight or nine feet long. The cachalot, therefore, is probably one of the moſt rapacious fiſhes of the deep: and is as deſtructive among the leſſer tribes, as the whale is harmleſs. But it is not to the ſmaller fiſhes alone, that this animal is formidable; among theſe the conteſt is ſoon ended, for it can devour thouſands at one ſwallow; it purſues and terrifies thoſe of its own order, the dolphin, and the porpeſſe to ſuch a degree, that they are frequently driven aſhore in endeavouring to eſcape.

Of the cachalot there are no leſs than ſeven varieties: That of a black colour, with two fins; the cachalot with a white back, and the ſame number of fins; the ſpecies with its ſpout-hole in the neck; that with the ſpout near the mouth; that with three fins, and ſharp pointed teeth; that with three fins, and ſharp edged teeth; and, laſtly, the cachalot with three fins, and flat teeth. All theſe were indiſcriminately termed ſpermaceti whales *, till Mr. *Pennant* borrowed that name from the *French*, by which they are now diſtinguiſhed †.

From the ſmallneſs of its ſize, as well as its fierceneſs and agility, the capture of the cachalot would ſeldom be attempted by the fiſhers, were it not for the ſake of thoſe valuable medicines, ſpermaceti and ambergris,



* Dale's Harwich. p. 413.

† *Vide* Brit. Zool. Claſs iv. Gen. 2.

which theſe animals have been found to contain. The various purpoſes to which theſe ſubſtances are applied, both as drugs and articles of luxury, have rendered the cachalot, which ſupplies them, a fiſh in great requeſt, and its capture the moſt advantageous object in the *Greenland* trade.

Spermaceti is the name erroneouſly given to that ſubſtance which is found in the head of the cachalot, and which is by no means the ſemen, but the brain of the animal. *Goldſmith* gives the following account of the method by which it is extracted *. The outward ſkin of the head being taken off, a covering of fat appears, about three inches thick; and under that, inſtead of a bony ſkull, the animal has only another thick ſkin, that ſerves for a covering and defence of the brain. The firſt cavity or chamber of the brain, is filled with that ſpermaceti which is ſuppoſed of the greateſt purity, and is of the higheſt value. From this cavity there is generally drawn about ſeven barrels of the cleareſt ſpermaceti, that, thrown upon water, coagulates like cheeſe. Below this there is another chamber, juſt over the gullet, which is about ſeven feet high; and this alſo contains the drug, but of leſs value. It is diſtributed in this cavity, like honey in a hive, in ſmall cells, ſeparated from each other by a membrane like the inner ſkin of an egg. In proportion as the oily ſubſtance is drawn away from this part, it fills anew from every part of the body; and from this is generally obtained about nine barrels of oil. Beſides this, the ſpinal marrow, which is about as thick as a man's thigh, and reaches all along the back-bone to the

* Nat. Hiſt. vol. vi. p. 219.

the tail, where it is no thicker than one's finger, affords no inconſiderable quantity.

Formerly the ſpermaceti was obtained but in ſmall quantities, and was ſold at a very high price, from the ſuppoſition of its great efficacy as a medicine. Though it ſtill enters into the compoſitions of the apothecary, yet it is rather to give a conſiſtency to his medicines than to add to their virtue: and ſince the art of converting the whole oil of the cachalot into ſpermaceti by boiling has been diſcovered, the article has decreaſed rapidly in its value. It has now fallen below the price of wax, and is uſed inſtead of it for candles.

Ambergris is the other medicine, for which mankind are indebted to the cachalot; and this ſubſtance, rather than the former, ſhould have obtained the name of ſpermaceti, becauſe it is found in the place where the ſeminal veſſels of other animals are commonly ſituated. For a long time the world was taught to believe, that ambergris was a ſubſtance to be found only in ſmall quantities upon the ſurface of the water. The trade in theſe articles was originally in the hands of men of obſcure and ſuſpicious characters; and this was one of the arts by which they endeavoured to add to the myſterious nature, and value of the commodity. Time, which reveals the ſecrets of the mercenary, has at laſt diſcovered that this medicine is the produce of the cetaceous fiſhes *.

Among the inteſtines of the cachalot is found a bag three or four feet long, filled with liquor of a yellowiſh colour, and thinner than oil; and in this fluid, the ambergris is ſeen floating in round lumps, from one to twen-



* Goldſmith's Nat. Hiſt. ubi ſupra.

ty pounds weight, and never above four in the ſame fiſh. Theſe balls of ambergris, the purpoſes of which, in medicine and perfumes, are ſo well known, are not indiſcriminately found in every fiſh: it is only the oldeſt and ſtrongeſt that yield it in any conſiderable quantity.

## *The Blunt Headed Cachalot*.*

This ſpecies ſometimes viſits the coaſts of *Britain*: A dead one was caſt aſhore near *Edinburgh* in the year 1769, which meaſured fifty-four feet, from the mouth to the tail; and its greateſt circumference was thirty feet†.

The head of this animal is of an enormous ſize, far exceeding the proportions of the whale. The upper jaw projects five feet beyond the lower; and its length is about fifteen feet, the other being only ten. Near the ſnout, which is quite blunt, and near nine feet high, is placed that oriſice peculiar to the cetaceous order, by which they ſpout the water. The lower jaw is armed with forty-ſix teeth, all pointing outward to meet the ſockets, where they enter into the upper. The teeth are about ſeven inches in circumference at the bottom, ſharpening as you approach the top; they are all bent, and like the teeth of the other cetaceous fiſhes, they are white,

* Le cachalot a dents en faucilles. Briſſon. Phyſter. Microps. Lin. Syſt.

† Britiſh Zoology, claſs iv. gen. 2.

white, and poliſhed like ivory. Far back, and towards the hind part of its monſtrous head are placed the eyes, which are very ſmall in proportion to the ſize of the animals whoſe motions they are intended to direct. The back fin of this ſpecies is wanting, and in its place there is found a large protuberance: The two pectoral fins are placed hard by the corners of the mouth, and are about three feet long. The penis is ſeven feet and a half; the tail bifurcated, and fourteen feet from tip to tip. Such are the monſtrous dimenſions of this unſhapely animal. In its great outlines we ſtill recognize the general characters of the order; and though inferior in ſize to the whale, it is far more tremenduous in its aſpect, and fiercer in its manners *.

## *The round headed Cachalot* †.

This fiſh is deſcribed by *Sibbald* ‡, who mentions a ſhoal conſiſting of an hundred and two that was caſt on ſhore at the ſame time upon the *Orkney* iſles. According to that writer, it wanted the ſpout-holes, that are reckoned characteriſtic of this order of fiſhes; it is probable, however, that what he has deſcribed as noſtrils, was this

* *Vide* Phil. Tranſact. vol. LX.

† Phyſiter Catodon. Lin. Syſt. Le Petit Cachalot. Briſſon.

‡ Sib. Phalain. ix.

this opening, which nature, as we have already ſeen, has deſtined for a different purpoſe.

This ſpecies is far inferior in ſize, to that above deſcribed; the largeſt of that great number juſt mentioned did not exceed twenty-four feet in length. Its head is round, and the ſhape of the teeth the reverſe of thoſe of the blunt headed kind. They are ſmaller at the back, than at the top, where they are quite flat, marked with concentric lines. Their bottom is pierced with a ſmall orifice, bearing no reſemblance to the large cavity, deſcribed in the former ſpecies. The back fin is wanting; inſtead of it is a rough knotty kind of ſpace *.

* Britiſh Zoology.

## Section IV.

### Genus IV.—*The Dolphin.*

In reviewing the different tribes of cetaceous fiſhes, we find them, in proportion as they diminiſh in ſize, growing ſtill more active and voracious. The fiſhes of this genus, which comprehends in it three different families, that of the dolphin, the grampus, and porpeſſe, are all much leſs in bulk, than the common whale. They have all fins upon the back, and like the reſt of the whale kind, they have heads diſproportioned in ſize to the reſt of the body. Each of the three ſpecies have both jaws armed with formidable teeth; for nature has not conferred upon them an extraordinary voracity, without beſtowing the means of gratifying it.

From their great agility, the fiſhes of this genus are not frequently taken. They ſeldom remain a moment above water; ſometimes, indeed, their too eager purſuits expoſe them to danger; and a ſhoal of herrings allures them out of their depth. In this ſituation, the wretched animal continues to bounce and flounder in the ſhallow water, till it is knocked on the head, or till the returning tide again comes to its relief. The porpeſſes are often allured up the *Thames* in this manner, till they are ſurrounded with

with boats, from which the fiſhermen ſhoot them with fire arms*.

In their internal ſtructure theſe animals reſemble quadrupeds, and the other cetaceous fiſhes. Conception is begun by the introduction of ſemen, and after ten months, a perfect animal is produced. They bring forth their young only in the ſummer ſeaſon †; in the month of October the fœtus has been extracted from a dolphin but newly begun to form ‡. The young, after being produced, continue to follow the parent, till they have attained their full ſize, which is in about ten years. The longevity of theſe fiſhes was computed by *Ariſtotle* to be upwards of thirty years: The method practiſed to aſcertain it, ſeems but an aukward one: it was, by cutting off a part from the tail fin, and returning the animal to the ſea; and if the fiſh happened afterwards to be taken, its age was gueſſed at from that circumſtance.

## *The Dolphin* §.

Concerning the figure of the dolphin, properly ſo called, the ideas of the ancients were exceedingly erroneous. Upon their marbles and coins, they are uniformly deſigned of

* Goldſmith's Nat. Hiſt.

† Miſtot. Hiſt. anim. lib. vi.

‡ Willough. lib. ii. p. 30.

§ Delphinus Antiquorum, Willough. Le Dauphin. Briſſon.

Plate II.

DOLPHIN

of a crooked form: From the deſcriptions of the poets, it appears that they entertained the ſame inaccurate notion of the ſhape of this animal *. Before a ſtorm the dolphins are obſerved to be in great commotion, and frequently to leap above the ſurface of the water. It is probably in this attitude, almoſt the only one in which they were then ſeen, that they have a crooked appearance to the eye †. The natural ſhape of the dolphin is almoſt ſtraight, the back being very ſlightly incurvated, and the body ſlender.

But it is not in the external form alone of the dolphin that the ancient writers were miſtaken: Their philoſophers and hiſtorians ſeem to have contended who ſhould invent the moſt extravagant fables concerning it. This fiſh was celebrated in the earlieſt time for its fondneſs of the human race. It does not dread man, ſays *Pliny*, as a ſtranger; but comes to meet him in the ſhip, and to ſport around the veſſel: hence it was diſtinguiſhed by the epithets of *boy loving*, and philanthropiſt ‡. It was conſecrated to the gods; and therefore was honoured with the title of *ſacred* fiſh. Various are the ſervices which this race are ſaid to have performed to man: *Pliny*, *Aelian*, and many of the other early writers ſet no bounds to their belief of the tales related concerning the dolphin's attachment to the human ſpecies: *Pliny* the younger, who lived in an age leſs remarkable for credulity, makes an apology for the ſtory of the enamoured dolphin of *Hippo*, which he narrates in a beautiful manner §.



* Tumidumq: pando tranſilit dorſo mare. Seneca Trag. Agam. 459.

† Bellonius apud Willough. p. 30.

‡ Britiſh Zoology, vol. iii. p. 65.

§ *Vide* Epiſt. lib. ix. ep. 33.

From what cauſe the ancients were prejudiced in favour of the dolphin it is not eaſy to determine. The figure is ſuch as could create no partiality; its manners, which are fierce and rapacious, could ſtill leſs endear it; and it does not appear that this fiſh ſhews any attachment to mankind, more than the reſt of the cetaceous tribes. It perhaps has ariſen from commiſeration, on hearing that plaintive moan, by which, when taken, it expreſſes its ſufferings. In a veſſel where ſeveral dolphins were confined, ſays an old writer, I ſpent a night of great pain and uneaſineſs, ſo feelingly did theſe wretched creatures expreſs the miſeries of their condition, in cries and lamentations, reſembling the human. Their ſufferings forced from me tears of compaſſion; and while the fiſherman was aſleep, I forced the one that ſeemed to ſuffer the greateſt agony overboard into the ſea. This act of tenderneſs availed me nothing; for the moaning of thoſe that remained behind, ſeemed only to be encreaſed; who made ſigns too plain to be miſunderſtood, that they wiſhed for a ſimilar deliverance. Thus I ſpent the night in unavailing ſorrow for ſufferings that I could not alleviate *.

Theſe prejudices in favour of the dolphin, are now ſo wholly obliterated, that even the common people regard them in a very different light. Their appearance is far from being deemed a favourable omen by the ſeaman; for their boundings, ſports, and frolics in the water, are held to be ſure indications of an approaching ſtorm †. It is not known whether theſe motions of the dolphin are the gambols of pleaſure, or the effects of fear. They probably

* Gillius apud Willough. page 31.

† Britiſh Zoology, and Willoughb. lib. ii. p. 30.

bably are occaſioned by ſome preſentiment of that turbulence and commotion which is ſoon to take place in their element; a commotion which obliges the ſmaller fiſhes to ſink to the bottom, and which of courſe deprives them of their accuſtomed prey.

Almoſt every thing marvellous in natural hiſtory diſappears on farther acquaintance, and more accurate examination of the ſubject. This has been the fate of all thoſe extraordinary circumſtances related of the dolphin. So great is the number of thoſe animals that play around this iſland, and ſo frequently are they taken, that experience and ocular teſtimony, ſoon contradicted thoſe tales that had been the growth of credulity and ignorance.

The ſwiftneſs of theſe animals in the purſuit of their prey, and their extraordinary avidity to ſecure it, are almoſt the only peculiarities (if ſuch they can be called) which farther experience has aſcertained to belong to them, or at leaſt to characteriſe their manners. *Belon** long ago remarked, that they eaſily came up with the ſhip in which he was, though in full ſail before a briſk gale; and that they played around her, with a velocity reſembling that of a bird in the air. This extraordinary ſwiftneſs of the dolphin ſeems to be the combined effect of agility and ſtrength: by means of it they are enabled to make dreadful havoc among the ſalmon, herring and mackrel. They are frequently ſeen fighting pitched battles with the *amiæ*†. The two different kinds of fiſh range themſelves on each ſide, like contending armies. In one of theſe engagements, at the opening into the *Dardanelles*,

* Hiſt. Piſcium.

† A fiſh in the Mediterranean reſembling a ſalmon.

*danelles*, the *amie* were vanquiſhed, and put to a total rout by their victorious enemies *.

The dolphin, like ſome other kinds of cetaceous animals, have been obſerved to emigrate from one ſea to another. They have been known to paſs from the *Mediterranean* into the *Black Sea*; and after having remained for ſome time there, to return to their former haunts. When they are taken, as ſometimes happens, in the nets placed for other fiſhes, if they are not ſtrangled by their own efforts to eſcape, they will live for a long time after being brought to the ſhore: One has been carried alive from *Montpellier* to *Lyons* †.

In former times the fleſh of the dolphin was reckoned a great delicacy: it was bought by princes at a high price, and preſented at their moſt formal entertainments. This *Rondeletius* declares, he had more than once obſerved, though not among his own countrymen, where the practice of eating theſe fiſhes had entirely gone into diſuſe. This was alſo the caſe in *England* in the days of *Willoughby* ‡. At a more ancient period, however, theſe fiſhes were not only eaten, but held in as high repute among the *Engliſh*, as any other nation. Dr. *Caius* ſays, that one which was taken in his time, was thought a preſent worthy of the Duke of *Norfolk*, who diſtributed part of it among his friends. It was roaſted and dreſſed with porpeſſe ſauce; a compoſition of fine white bread mixed with vinegar and ſugar §.

The mouth of the dolphin is narrow and pointed, not unlike

* Hiſt. Piſcium.

† *Vide* Geſner and Rondeletius.

‡ *Vide* Hiſt. Piſcium lib. ii. p. 31.

§ Caij opuſcula, p. 116.

unlike the beak of ſome birds; and hence the *French* call it the ſea-gooſe *. Its teeth are forty-two in number, placed in both jaws, and bended a little towards the mouth. They are placed at ſuch a diſtance, that each tooth enters into a ſpace between two in the oppoſite jaw.

The ſkin of theſe fiſhes is ſmooth, of a duſky colour on the back and ſides; while the belly is white. The form of the tail is ſemilunar; that of the back fin, high, triangular, and placed nearer to the tail than the head †.

## *The Porpeſſe* ‡.

THE fiſhermen do not diſtinguiſh this fiſh from the dolphin, which it nearly reſembles: Both are known by the name of porpeſſe among the *Engliſh* ſailors; and the *French* with indiſcrimation call them *marſouins*. The latter word is derived from the *German*, and the former from the *Italian* language: the import of both is the the ſame, and expreſſes the reſemblance which this fiſh bears to a hog §. It is probably from the particular ſhape of the noſe, that the animal has obtained this name ſo generally among the modern nations of *Europe*. The ſnout projects conſiderably, though not ſo long as that of the

* Britiſh Zoology, L'oie de la mere.

† Idem, Claſs iv. Gen. iii.

‡ Le Marſouin. Briſſon. Delphinus Phorcæna, Lin. Syſt.

§ Meerſchwain denotes a ſea-ſwine, and Porcopeſce may be tranſlated hog-fiſh.

the dolphin: It is furniſhed with very ſtrong muſcles, which enable the fiſh more readily to turn up the ſand; for by this means the porpeſſe, as well as the ſwine, procures a great part of its food. When prey fails at the ſurface, it dives to the bottom in ſearch of ſea worms, and ſand eels which it digs up there.

The porpeſſe is diſtinguiſhed from the dolphin, by the ſuperior thickneſs of the head, as well as the ſhortneſs of the noſe: It is commonly of ſmaller ſize; the body groſs and fat towards the head, but tapering away in the form of a cone, till it becomes ſlender at the tail *. The colour of the back is generally black, and the belly white: This, however, is not an uniform character; for in the river of *St. Lawrence* there is a white porpeſſe; and there is in the *Britiſh* channel a ſmall ſpecies called thorn-backs, that are various, ſometimes brown, white and ſpotted †.

Both jaws of the porpeſſe, as well as thoſe of the dolphin, are provided with teeth; but in the former they are much more numerous, and of a ſmaller ſize than in the latter animal. They are forty-eight in all, moveable, and ſo ſituated as to lock into each other. The eyes are ſmall, reſembling thoſe of the human ſpecies, both in ſize and in the diſtribution of their humours ‡. It has no branchiæ, nor any aperture in their place; the ſpout-hole is upon the crown of the head, of a ſemilunar ſhape, and divided internally by a cartilaginous membrane, which appears at the ſummit of the head like the comb of a cock.

Towards the noſe of this animal there have been obſerved

* Willough. Hiſt. Piſc. page 28.

† Britiſh Zool. claſs iv. gen. 3.

‡ Dan. Major apud Willough.

ſerved no leſs than ſix concealed apertures or *foramina* leading to the brain, which have been ſuppoſed to be its organs of ſmell; a ſenſe which it probably poſſeſſes in a greater degree than other fiſhes.* The tongue is flat, pectinated at the edges, and faſtened down to the bottom of the mouth †.

The ſtructure of the viſcera of this fiſh appears more complex, and indicates an organization ſomewhat ſuperior to the reſt of the tribe; we are perſuaded however, that a more minute examination of the parts would diſcover an exact conformity between it and the different cetaceous tribes. The porpeſſe, according to *Willoughby* ‡, has three ſtomachs: the firſt, large, wrinkly and muſcular, for reducing the ſhells of fiſh which it devours; the ſecond was alſo large, empty, and furniſhed with ſmaller muſcles; the third appeared a kind of adjunct to the other two, and contained a quantity of aſſimulated chyle, of a livid colour.

The whole body of the porpeſſe, immediately below the ſkin, is covered with a coat of fat reſembling lard, of an inch thick. Various uſes, in the economy of the animal, are aſſigned to this ſubſtance: it is ſuppoſed to defend the body from injury and cold; to diminiſh its weight ſo as to make it equiponderate with the water, in order that the fiſh may alternately riſe and ſink without effort, while employed in the different operations of breathing and collecting food. Beneath this coat of fat lies the fleſh, red, thick, and muſcular, reſembling that of a hog §.

Of all the cetaceous fiſhes, the porpeſſes are found in greateſt

* Dan. Major apud Willough. † Britiſh Zool. ubi ſupra.
‡ Hiſt. piſcium, page 33. § Idem ubi ſupra.

greateſt abundance around the *Britiſh* iſles. In ſuch vaſt numbers do they appear in ſome places, that the fiſhermen are not ſafe to venture among them in a ſmall boat. When gamboling upon the ſummit before a ſtorm they appear almoſt to darken the ſurface of the water *. In times of fair weather, they are ſeen herding together, and purſuing the ſhoals of mackrel with great impetuoſity. Their manner of hunting after their prey is diſtinguiſhed by the ſame eagerneſs and diſpoſition to act in concert, that is obſerveable among dogs when purſuing a hare †. They are ſeen urging them from one bay or creek to another, deterring them from the ſhallow water, and driving them towards each other's ambuſh, with all the art of an experienced greyhound.

## *The Grampus* ‡.

THIS animal ſeldom exceeds the length of twenty-five feet, but is remarkably thick in proportion, the breadth being to the length, as ten to eighteen. It was with reaſon that *Pliny* called it an immenſe heap of fleſh, armed with dreadful teeth §. From its reſemblance to a wine caſk in the thickneſs and rotundity of its form, it obtained the name of *orca* among the ancients.

The noſe of the grampus is flat, and turned up; the under

* Pennant's Brit. Zool. † Goldſmith's Nat. Hiſt.

‡ L'Epaulard, Briſſon. Delphinus Orca L n. Syſt.

§ Cujus imago nulla repreſentatione exprimi poteſt alia, quam carnis immenſæ dentibus truculenti s. Lib. ix, cap. vi.

under lip is ſo thick and heavy, that when the animal is on its belly, it is ſeparated from the upper *. The teeth are ſixty in all, thirty upon each jaw; and between each is a ſpace adapted to receive thoſe of the oppoſite ſide, when the mouth is ſhut †. Thoſe upon the fore parts are blunt, round, and ſlender, the innermoſt ſharp, and of great thickneſs. The ſpout hole in this ſpecies, is placed at the top of the neck; the animal is covered with a ſtrong ſkin, like leather, black upon the back, but diſplaying a large ſpot on each ſhoulder, of the ſame colour with the belly, which is white; the ſides are marbled with black and white ſpots ‡.

The grampus is of all the cetaceous fiſh the moſt fierce and voracious; it does not even ſpare the porpeſſe and whale, which are animals of its own order and of ſuperior ſize; the latter of theſe fiſh it is ſaid to tear and mangle in ſuch a manner with its teeth, that it bellows like a bull from the pain of its wounds ||. The fiſhers who formerly repaired to the coaſts of *America*, prohibited the ſavages from deſtroying this fiſh; for by its aſſiſtance they were aided in the capture of whales, ſeals, and other animals: whilſt the grampus purſued theſe, and the other monſters of the deep, they were frequently obliged to betake themſelves to the ſhallow water in order to eſcape its mercileſs teeth, where the ſeamen were ready to kill them with javelins and harpoons.

This ſpecies is a profitable capture for the fiſhers, as it is ſaid to yield a very conſiderable quantity of oil; like the porpeſſes, it ſometimes appears upon the *Britiſh*



* Vide Will. Orca. Lib. ii. p. 40.
† Sibbald, Phalæn. 7, 8. ‡ Brit. Zool. Claſs iv. gen. iii.
|| Willough. ubi ſupra.

coaſts; but its great reſort is off the *North Cape* of *Norway*. The number and poſition of the fins are the ſame as in the dolphin; and it reſembles all the other cetaceous animals in ſwimming againſt the wind, and in that tumbling and agitation which it diſcovers on the approach of a ſtorm.

# CHAPTER V.

## SECTION I.

### *General Characters of the Cartilaginous Fishes.*

IN the organs prepared by nature for the reſpiration of animals, there is a great difference between thoſe formed within the body, called lungs, and that apparatus at each ſide of the head, known by the name of gills. Among all the terreſtrial animals, and the cetaceous fiſhes, breathing is performed by the former of theſe contrivances, and among the ſpinous fiſhes it is carried on by the latter; between theſe two orders of the animal kingdom, there is placed a third, which unites them in the great ſcale of being, and partakes in ſome meaſure of the nature of each. Theſe are the cartilaginous fiſhes, which, while they are furniſhed with apertures on each ſide of the neck, correſponding to the gills of the ſpinous fiſhes, are alſo ſupplied with lungs within the cavity of the body, analagous to what we have already ſeen among the terreſtrial and cetaceous tribes.

From this double conformation in the organs of breathing, it would at firſt view appear, that the cartilaginous tribes were a kind of privileged order of animals, poſſeſſing a greater variety of endowments than the reſt of

the animal kingdom. It would appear that they are capable of ſubſiſting indiſcriminately in either of theſe two elements, to each of which the ſtructure of their parts ſeem to have a reference; it was no doubt this aſpect of the cartilaginous fiſhes, which preſented itſelf to *Linnæus* when he arranged them in the ſame order with thoſe animals, properly amphibious *, that are capable of ſubſiſting either in the water or in the air. Of this power, however, this claſs of beings is by no means poſſeſſed; for, though they are capable of ſupporting life for a longer time on ſhore, than the ſpinous fiſhes, yet there is hardly any of them that can live there above a few hours at a time †. Whatever, therefore, be the ſtructure of their organs, there is none of them properly amphibious, or that juſtly merits a place among that order of beings.

But although the double ſtructure of the organs of reſpiration in the cartilaginous fiſhes, will not juſtify us in placing them among the fiſhes, tortoiſes, lizards, and other animals that are ſtrictly amphibious, it forms, however, a very palpable mark of diſtinction between them and the cetaceous fiſhes on the one hand, and the ſpinous upon the other; from the latter they are known, becauſe, though they have apertures correſponding to gills, they univerſally want the bony *opercula* which covers them ‡.

Theſe apertures by which they breathe, are placed always near the head, but have not uniformly the ſame poſition: In ſome they are placed beneath, as in the rays, and other flat fiſh; in others on the ſides, as among the ſhark

* He has termed them amphibia nantes. Vide Syſtema Naturæ.

† Willough. Ichthyol.

‡ Pennant's Brit. Zool. Claſs iv. Div. ii.

ſhark tribe; and among a third claſs, they are ſituated on the top of the head, as exemplified by the pipe fiſh.

From theſe foramina, there are two bending cylindrical ducts, that run to the lungs, and are ſuppoſed to convey the air that gives their organs their proper play: The heart, however, has but one valve; and hence, their blood does not perform that double circulation which obtain among the cetaceous kinds, and the lungs ſeem rather an internal aſſiſtant to the gills, than for ſupplying the ſame purpoſe which they do in quadrupeds, for they want both the pulmonary vein, and artery.

Another ſtriking character by which this order of the animal kingdom may be diſtinguiſhed, is, that their fleſh is ſupported by cartilages inſtead of bones. In the cetaceous tribes we have ſeen, that the bones were hard, and filled with marrow, reſembling thoſe of quadrupeds, while theſe parts in the ſpinous tribes, are ſmall, ſlender, and pointed, reſembling thorns, and generally ſolid throughout. The ſize of other animals increaſes with their age, and ſtops at a certain point; but from the pliancy of the bones in this tribe, they ſeem to have no bounds placed to their dimenſions, and it is ſuppoſed that they grow larger every day till they die †.

A third general character of theſe fiſhes ariſes from their manner of generation; ſome of them are oviparous, while the greater part produce living young; the ſame duplicity of character attending them in this reſpect, which we have already taken notice of with regard to their conformation. In thoſe that are viviparous, the progeny is excluded from an egg hatched within the body

† Goldſmith's Nat. Hiſt. vol. ii. p. 231.

dy of the female; this egg conſiſts of two parts, the white and red, as in thoſe of birds, and inſtead of a ſhell, it is lodged in a caſe formed of a thick tough ſubſtance, reſembling a horn that has been ſoftened in boiling water *.

The oviparous fiſhes of this claſs produce their young nearly in the ſame manner; in theſe as well as in the viviparous kinds, the egg is hatched for ſome time in the belly of the female, but before the fetus is diſengaged from it, is excluded from the womb, and left till time and the warmth of the ſun bring the incloſed offspring to maturity. Both differ remarkably from the whales and the quadrupeds, whoſe eggs ſtart from the ovarium, and enter the uterus at the time of conception, where they remain only a few days, till they leave that ſtate, and are formed into a complete fœtus.

There are other diſcriminating characters belonging to this order, leſs diſcernible indeed, but ſuch as mark a difference between them and the adjoining tribes. The ſpinous fiſhes we ſaw had no aparatus for hearing; it is probable, however, that the cartilaginous are furniſhed, though imperfectly, with the organs of this ſenſe; upon each ſide, near the eyes, there is an aperture which opens into the mouth, the ſuppoſed uſe of which is partly to convey the water into the mouth, which is expelled through the gills, and partly to convey ſounds to the cenſorium †. In this reſpect, therefore, the cartilaginous fiſhes may be deemed a more accompliſhed race than many of their companions of the deep.

The

* Britiſh Zool. ubi ſupra. † Will. Ichthyol. Lib. iii. p. 45.

The fiſhes of this order are poſſeſſed both of gills and lungs, and are thereby in ſome meaſure capable of deriving aid from both elements, to their neceſſities and enjoyments; the manner of their parturition is alſo various: and we are now to contemplate them in the double enjoyment of another qualification. The males of this race copulate with their females, *more hominum;* and in them the external organs of generation are two-fold *. Theſe inſtruments project forward from each ſide of the abdomen; and whether it be that theſe animals poſſeſs more warmth of conſtitution, or a greater capacity of bringing their offspring to maturity, they generally chooſe colder ſeaſons and ſituations for producing their young, than other fiſhes; many of them propagate in the midſt of winter, and far from the ſhore †.

The cartilaginous fiſhes, though not ſo remarkable either for fatneſs or ſize, are in general more voracious than any of the tribes we have already reviewed; their livers are indeed fat, and are ſometimes employed for the production of oil; it is not, however, from them that man derives either his moſt pleaſant or ſalubrious food; they are impure and immoderate feeders, and their fleſh favours of that impurity ‡. Of a conſiderable portion of them, the mouth is placed below the head; a contrivance of Nature, for which an old writer aſſigns ſome curious reaſons: Their ſnout, ſays he, is too ſmall to be divided; and their voracity is ſo keen, that their own life requires that it ſhould not be allowed a ready or complete gratification §.

From

* Idem ubi ſupra. † Goldſmith's Nat. Hiſt.

‡ Will. Ichthyol. Lib. iii. p. 45.

§ Vide Rondeletius de piſcibus. Lib. iii. cap. 4.

From this conformation of the mouth, a great part of the cartalaginous fiſhes are obliged to turn their back downwards in laying hold of their prey; a circumſtance that requires time, and affords an opportunity to the ſmaller fiſh of making their eſcape. They devour every kind of fiſh or fleſh, and to their extraordinary voracity, had Nature granted the power of eaſily apprehending their food, the other kinds of fiſh muſt long ago have fallen a ſacrifice to their gluttony *.

* Idem ibidem.

## Section II.

### Genus V.—*The Lamprey.*

Of this genus, *Linnæus* has enumerated only three ſpecies, though it is probably diverſified into a greater number of different kinds *; his catalogue conſiſts of the ſea lamprey, the river or leſſer lamprey, and the pride. He makes mention of the muræna, that fiſh ſo much celebrated among the epicures of ancient *Rome*, although ſo nearly allied to this genus, that it ſeems to merit a place there. There is a ſpecies of lamprey eſteemed a great delicacy by the modern inhabitants of *Italy*, different from ours, and probably the ſame fiſh with the ancient *Muræna*, as it is reared in ponds, and fed in the ſame manner. The genuine characters of theſe fiſhes are: A long and ſlender ſhaped body, reſembling that of a ſnake; the ſkin has no ſcales, but is covered with a ſlimy glutinous mucus; they have ſeven apertures for breathing upon each ſide, and one like the cataceous fiſhes upon the top of the head; both the pectoral and ventral fins are wanting.



* Vide Syſt. Nat. p. 394

## *The Muræna* *.

THIS ſpecies, we are told, obtained its name from its continually floating upon the ſurface of the water, by reaſon, as was ſuppoſed, of its extraordinary fatneſs †. In ſhape it reſembles an eel; the ſnout more protuberant, ſharp and compreſſed: Its colour variegated with ſhades of yellow, brown, and black. The head is ſmall, but the opening of the mouth capacious. The margin of each jaw is ſurrounded with a ſingle row of very ſmall teeth: upon the ſnout there are two apertures, and above the eyes other two; the former, as is ſuppoſed, are the organs of ſmell, and the latter of hearing ‡. The ancients believed that this animal was endowed with a very acute ſenſe of hearing, and that the fiſhermen could allure it to the brink of the water by hiſſing, and by that means take it §.

Like the other fiſhes of this genus, it wants the pectoral and ventral fins; but a little beyond the head there ariſes a fin, which ſtretches along the back to the tail, and turns round to the belly, terminating at the anus: This fin is covered with the common legument of the body, and is eaſily laid bare by flaying the animal.

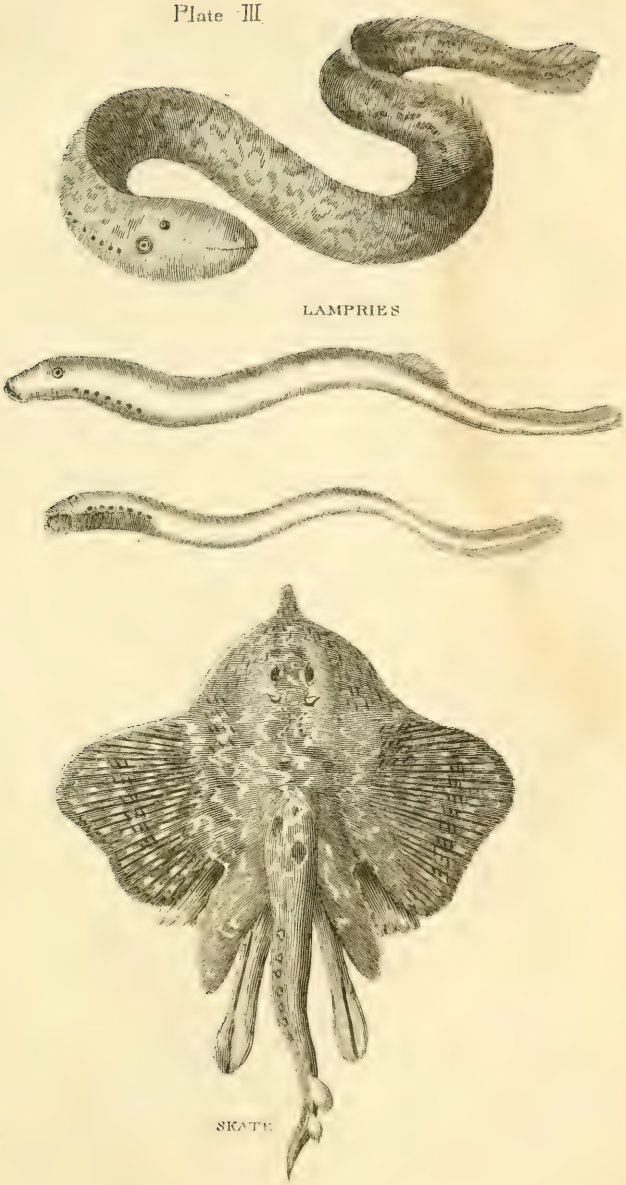
The bite of the muræna was deemed ſo poiſonous by the fiſhermen, that in taking the animal, they uſed every precaution to prevent its effects: They tumbled them immediately

* Muræna omnium auctorum. Will. Ichthyol.

† Παρα το μυειν. Vide Macrob.

‡ Will. p. 103. § Plinii. Hiſt. Nat.

Plate III.



LAMPRIES

SKATE

mediately from the net into the boat, where they laid hold of the head with a forceps, rubbed its ſnout againſt ſome hard ſubſtance to deſtroy its teeth, and beat it on the tail, where the life was ſuppoſed to lie *. That the principle of life, among eels in general, is placed in the tail, is ſtill a prevalent opinion; and when taken, it is not by beating the head, but the tail, that the fiſher endeavours to deprive them of animation.

Poiſonous as the bite of theſe animals may be, and hideous in their external figure as they certainly are, yet theſe circumſtances did not prevent the luxurious citizens of ancient *Rome* from adding them to the endleſs liſt of delicacies with which they pampered their appetites †. This ſpecies, the baſſe (*Lupus*), and a kind of mullet (*Myxo*), formed that pride of *Roman* banquets, the *tripatimam*; ſo called, according to *Arbuthnot*, from their being ſerved in a machine of three bottoms ‡.

The fleſh of this animal muſt be various, according to the manner in which it is fed; it is ſaid, however, to be in general white, tender, and of an agreeable flavour §. It was reared with much care in the fiſh ponds of *Italy*, and ſold at a high price; of its eſtimation among the ancients, we have full evidence in all the claſſics, that have either praiſed good eating, or ridiculed gluttony. A ſenator of *Rome*, whoſe name will be tranſmitted with infamy to poſterity, was highly complimented for the delicacy of his murænæ. *Tigellinus*, *Manucius*, and all the celebrated epi-



* Plinii Hiſt. Nat. lib. 32. cap. 2.

† Pliny, Ovid, Juvenal and others.

‡ Atque ut luxu quoque aliqua contingat auctoritas figlinis *Tripatinam*, inquit Fæneſtella apellabatur, ſumma cænarum lautitia: Una erat Muranarum, altera Luporum, tertia Myxonis piſcis. Plinii Hiſt. Nat. lib. 35. cap. 12.

§ Willough. lib. 3. p. 104.

cures of his time, were loud in his praiſes: No man's fiſh had ſo rich a flavour, were ſo nicely fed, or ſo exactly pickled. *Auguſtus* hearing ſo much of this man's entertainments, deſired to be his gueſt; and ſoon found, that fame had been juſt to his merits; the man had indeed fine murænæ, and of excellent flavour. The Emperor was deſirous of knowing the method by which he fed his fiſh to ſo excellent a reliſh; and the glutton, making no ſecret of his art, informed him that his way was to throw into his pond ſuch of his ſlaves as had at any time diſpleaſed him. *Auguſtus*, it is ſaid, was not much pleaſed with his receipt; and inſtantly ordered all his ponds to be filled up. *Goldſmith*, who narrates this ſtory, adds, that it would have ended better, had he ordered the owner to be flung in alſo *.

## *The Sea Lamprey* †.

THIS is a *Britiſh* fiſh, of which the names *lampetra*, and *petromyzon*, lately given it, are expreſſive of a habit this animal poſſeſſes of ſucking and adhering to ſtones ‡. The mouth is of a round form, placed rather obliquely below the noſe, and reſembling that of a leech. Like that animal, it poſſeſſes the extraordinary power of ſticking to any ſubſtance to which it is applied; and that with ſuch firmneſs, as not to be drawn off without ſome difficulty.

* Goldſmith's Nat. Hiſt.

† Petromyzon Marinus, Lin. Syſt. La Lamproye de Mer. Belon.

‡ The firſt lampetra, a lambendo petras; and the other, from Πετρος and Μυζαω, becauſe they are ſuppoſed to lick the rocks.

culty *. One that weighed but three pounds, has been known to adhere ſo firmly to a ſtone of twelve pounds, that it remained ſuſpended at its mouth. This amazing power of ſuction muſt ariſe from the animal's exhauſting the air within its body by the hole over the noſe; while the mouth is cloſely fixed to the object, and permits no air to enter †. The weight which the lamprey is by this means able to ſuſtain, will be equal to that of a column of air of the ſame circumference with the animal's mouth.

The lamprey ſometimes grows ſo large, as to weigh four or five pounds; its colour is duſky, irregularly marked with dirty yellow. In the mouth are placed twenty rows of ſmall teeth, diſpoſed in circular orders, and placed far back near the throat, four, five, and ſix, in each row ‡. The branchiæ are ſituated within the ſeven apertures, that are found on each ſide of the neck. Though in ſhape this animal reſembles an eel, yet it is of a thicker and more clumſy form.

The ſea lamprey, we ſhould imagine from its name, was only produced in the ſalt water; it is found, however, very frequently at the opening of large rivers, where they join the ocean. At certain ſeaſons it is found in many of the *Britiſh* rivers, and alſo in the *Iriſh*. They are ſea fiſh; but, like ſalmon, quit the ſalt waters, and mount the rivers about the end of winter, and after remaining there for a few months, return again to the ocean §.

As our manners are probably ſtill far ſhort of that ſenſuality and extravagance which diſtinguiſhed the ancient

* Pennant's Britiſh Zoology. † Goldſmith's Nat. Hiſt. vol. 6. p. 270
‡ Willough. Ichthyol. p. 106.
§ Brit. Zool. ubi ſupra. *Vide etiam* Willough.

cient *Romans*, we do not hear ſo many fanciful encomiums on particular diſhes, nor ſuch enormous ſums paid to procure them. Accordingly, the lamprey known among us, has obtained no very extraordinary character. It is differently eſtimated, according to the ſeaſon it was taken, or the place where it was fed. The beſt ſeaſon for them is in the months of March, April and May; for they are more firm immediately after their arrival in the rivers from the ſalt water, than afterwards. Towards the Summer, and in the hot weather, after they have depoſited their ſpawn, they are obſerved to be much waſted; and their fiſh becomes flabby, and bad eating *. Thoſe caught in ſeveral of the rivers in *Ireland*, the people will not venture to touch †; and throughout the whole of *Scotland* they are held in deteſtation: while thoſe taken by the *Engliſh* in the *Severn*, are conſidered by them as the moſt delicate of all fiſh whatever. Prejudices, though of oppoſite kinds, ſeem to operate in each of theſe caſes, whether in producing diſguſt or predilection.

At a very early period, we find, the lamprey was reckoned a great delicacy by the *Engliſh*: That they are a heavy ſurfeiting food, the experienee of one of their monarchs fatally teſtified; for the death of *Henry* I. was occaſioned by eating too plentiful a meal of theſe fiſhes ‡. Notwithſtanding this accident, they ſeem to have continued in high eſteem, becauſe we find *Henry* IV. granting protection to ſuch ſhips as brought over lampreys for the table of his royal conſort; and his ſucceſſor iſſuing out a warrant to *William* of *Nantes*, for ſupplying him and his army with theſe fiſhes, wherever they might happen to march §.

In

* Britiſh Zoology.

† Goldſmith's Nat. Hiſt.

‡ *Vide* Hume's Hiſt. of England.

§ Rymer ix. 544. apud Pennant.

In proof of the ancient predilection of the *Engliſh* for this fiſh, it is a cuſtom, from time immemorial, for the city of *Glouceſter* to preſent annually his majeſty with a lamprey pye, covered with a large raiſed cruſt. As the gift is made at Chriſtmas, it is with great difficulty the corporation can procure any freſh lampreys at that early ſeaſon, though they offer a ſum far exceeding their uſual price *. The various methods of taking the lampreys, it is not the buſineſs of this work to deſcribe.

The fiſhes of this genus, from ſome peculiarity in their conformation, generally ſwim with their body on a level with the ſurface of the water; and, it is ſaid, can eaſily be ſuffocated, by being immerſed in it for any conſiderable time. From this circumſtance, it is probable that they require a conſtant ſupply of air for breathing, and that they are poſſeſſed of lungs, though no naturaliſt has obſerved them in giving an account of the viſcera of theſe animals.

Among this tribe, copulation is performed *ventribus commiſſis*, contrary to the manner of the greater number of fiſhes: When engaged in the buſineſs of procreation, they generally frequent the ſhallow water, where their habits admit of being eaſily examined. The female, when ready to ſpawn, digs a hole in the mud, where ſhe depoſits her ova; and in this operation, the power of ſuction, which we have already deſcribed, is of ſingular advantage; for, ſhould ſhe meet with a ſtone, though of conſiderable bulk, ſhe raiſes and carries it out of the way †. After the ova are excluded, and buried in the excavation thus formed, the parent remains in the neigh-

* Britiſh Zool. claſs iv. gen. iv. † Balnerus apud Willough.

neighbourhood till the young are quickened into life. She is then ſeen, with her numerous family playing around her; which, as ſoon as they have acquired ſufficient ſtrength, ſhe gradually conducts to the ſea.

## *The River Lamprey* *.

THIS ſpecies is ſmaller than the former, ſeldom exceeding ten inches in length; and is diſtinguiſhed by tranſverſe lines of a blackiſh colour †. The mouth is of the ſame round form as in the preceding fiſh, and is poſſeſſed of the ſame adheſive power. On the upper part of it, is a large bifurcated tooth; on each ſide there are three rows of very minute ones; and on the lower part there are ſeven, the exterior of which on each ſide is the largeſt ‡.

Like all the other fiſhes of this genus, there is between the eyes a ſpout-hole or oriſice, reſembling that of the cetaceous fiſhes, and probably deſtined for a ſimilar purpoſe, that of ejecting water from the throat and lungs. The back fin of the river lamprey is not continued uninterrupted to the tail, but is broken off; and behind it there riſes a ſecond, which goes round the tail, terminating at the anus.

This ſpecies, as well as the larger kind, is alſo eaten, potted and highly ſeaſoned: By ſome it is preferred to the ſea lamprey, being milder taſted. All theſe diſhes are

* Lampetra medium genus, Will. La lamproye d'eau doulce, Belon. Petromyzon fluviatilis, Lin. Syſt.

† Willough. page 106. ‡ Britiſh Zool. claſs iv. gen. iv.

are probably heavy and unwholeſome, more highly recommended by the epicure than the phyſician *. They are taken in ſuch vaſt numbers in the *Thames*, the *Severn*, and the *Dee*, that they conſtitute a conſiderable branch of trade. They are ſold to the *Dutch*, who uſe them for bait in the cod fiſhery: beſides what are conſumed in *England*, 450,000 have been exported in a ſeaſon for this purpoſe, at two pounds per thouſand.

## *The Pride* †.

THIS ſpecies is exceedingly ſmall, being from four to eight inches. It is a Britiſh fiſh, but found alſo in the rivers of of *Germany* and *Italy*. In the river *Iſis*, and other ſtreams near *Oxford*, they are abundant, where, inſtead of concealing themſelves, they roll in the mud, and never are obſerved to adhere to the ſtones, like the other lampreys ‡.

The back is of a livid colour, approaching to black; the belly ſilvery, and more reſplendent, than the larger kinds. The mouth is of an eliptical ſhape; within it are ſix or ſeven teeth, and above them a ſmall ſemicircular bone. Upon the top of the head is a ſmall tube, or aperture, like the cetaceous fiſh: The belly ſwells and contracts alternately, as in thoſe animals which breathe by means of lungs. It has two dorſal fins; the firſt riſing about the middle, and ſupported by ſmall tendons, that



* Willough. ubi ſupra.

† Lapern, or pride of the Iſis. Will. Petromyzon Branchialis. Lin. Syſt.

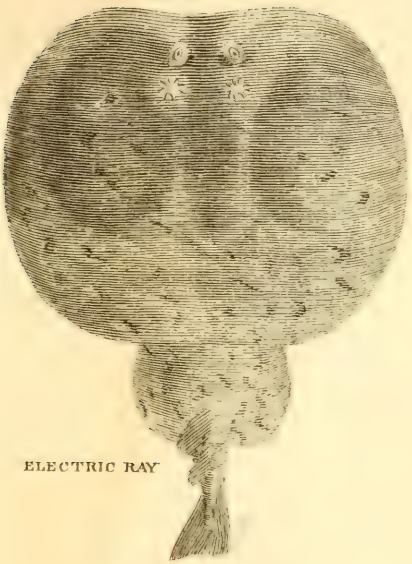
‡ Britiſh Zoology.

are ſcarcely viſible: The other takes its riſe immediately behind it, ſurrounds the tail, and terminates in the middle ſpace, between the tail and the anus *.

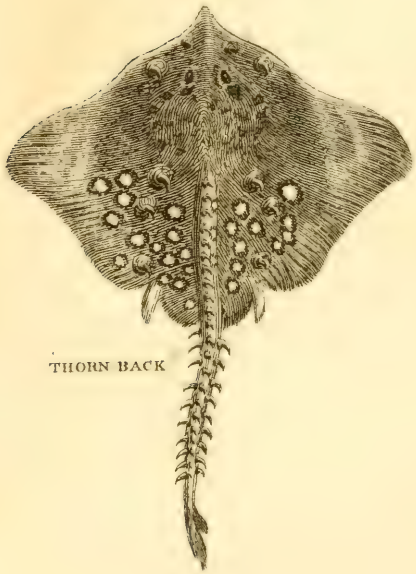
*Willoughby* deſcribes two other ſpecies of the lamprey; the *mucu* peculiar to the marſhes and lakes of *Brazil*; and the blind lamprey, a ſmall round fiſh, no larger than May worms: The laſt marked round the body with 84 tranſverſe lines, or annuli, reſembling thoſe upon the terreſtrial worm †.

* Willough. page 105. † *Vide* Icthyol. loco citato.

Plate IV.



ELECTRIC RAY



THORN BACK

## Section III.

### Gen. VI. *The Ray.*

This genus is eaſily diſtinguiſhed from all other kinds of fiſh, by a broad, flat, and thin conformation. The five branchial apertures on each ſide, are placed under the animal; they want the bony opercula, and are marked by the ſame peculiarities, that diſtinguiſh the other cartilaginous tribes. The mouth, in all the fiſhes of this genus, is ſituated quite below the head; while the body of the greater number is beſet with ſpines or prickles, reſembling thoſe on the branch of a thorn, a circumſtance from which they obtained their ancient name *; that of *ray*, which we now apply to the genus, is derived from the latin.

This genus comprehends all the rays, thornbacks, and flairs, or ſkates, which are diſtinguiſhed by manners as ſingular as their external form. *Willoughby* has deſcribed fourteen different ſpecies, and *Linnæus* nine; of which no leſs than eight frequent the *Britiſh* coaſts †.



* *Raia*, which ſignifies the berry that grows upon a prickly ſhrub, *Vide* Geſner.

† Syſtema Nat. and Britiſh Zool.

With regard to their dietical uſes, theſe fiſhes are very different; ſome of them affording a plentiful ſupply of ſalubrious food, while others are noxious and terrible; with reſpect, however, to their nature, appetites and conformation, the ſimilitude among them is perfect and entire.

Of all the larger fiſh, the rays are the moſt numerous; and their numbers are in a great meaſure owing to their ſize, and to the protection of thoſe frightful ſpines which nature has afforded them. There is none of the rapacious tribes, except, perhaps, the cachalot and white ſhark, that has a ſwallow ſufficiently large to receive them; and even theſe are, probably, often deterred from their purpoſes of deſtruction by the armour with which their prey is covered *. Of ſome the ſize is ſuch as to defy all the powers of deſtruction which even the ſhark himſelf is known to poſſeſs: In *England* ſome have been taken upwards of two hundred pounds weight; but that is far inferior to their enormous bulk in other parts of the world. Near the iſland of *Guadaloupe* in the *Weſt Indies*, a ray was killed, thirteen feet eight inches in breadth, and twenty-five from the ſnout to the tip of the tail. This member itſelf contributed largely to this prodigious dimenſion; for it was twenty inches broad at its inſertion, and tapered to a point, by which it terminated fifteen feet behind the body of the animal†.

The fiſhes of this genus probably attain to a much larger ſize, than that of any individual that has ever yet been examined: It is only the ſmalleſt of the kind that approach the ſhores; the larger continue forever prowling at

* Goldſmith's Nat. Hiſt. † Labat.

at the bottom, in the unfathomable caverns of the ocean, where they probably continue growing for ages. The utmoſt bulk of the ray cannot therefore be aſcertained; but it has been ſuppoſed, that they are the largeſt inhabitants of the ſea *. When, however, they ſurpaſs the ſize commonly obſerved by the fiſhermen, they become totally unfit for food; the negroes, and ſtarved ſavages of *America*, indeed, eat them up, even of the largeſt ſize; and the tenderer parts, when ſalted, are reckoned among their delicious morſels.

Theſe fiſh generate in March and April; at which time they ſwim near the ſurface of the water, ſeveral of the males purſuing one female: With ſuch avidity of deſire do they engage in the work of procreation, that the fiſhermen frequently draw up both male and female ſtill adhering together, though only one has taken the bait †. The females are prolific to an extreme degree, there having been no leſs than three hundred eggs taken out of the body of a ſingle ray. Theſe eggs, containing the fœtus, acquire a tough horny covering after deſcending into the womb; for while they continue in the *ovarium*, they are attached to it, like the ſmall eggs in the body of a hen; after they drop into the womb, the formation of the animal becomes viſible, and the ſhell is formed by the concretion of the fluids of that organ; when come to their proper maturity, the young are excluded, but never above one or two at a time, and at the interval of three or four hours. The females begin to caſt their purſes, as the fiſhers term it, in the month of May, and continue producing young till September. In October, when their

* Goldſmith's Nat. Hiſt. † Britiſh Zool.

their parturition ceaſes, they are exceedingly poor, and then they improve gradually during the winter and ſpring, till May, when they are at their higheſt perfection, and when they again begin to undergo the ſame functions *.

The rays generally frequent thoſe parts of the ſea where the bottom is black and muddy, where their voracity leads them indiſcriminately to devour every living animal which they can ſurpriſe: But although their appetite is ravenous and indiſcriminate, they become more delicate with regard to a baited hook; they devour below any putrid ſubſtance whatever, but if the bait has been taken up and ſuffered to lie for any time in the open air, they will not touch it: they appear by their manner to perceive the line, and to dread it; but the impulſe of their hunger is too great for their caution, and, even though they perceive the danger, if thoroughly hungry, they devour, as if regardleſs of deſtruction †.

Both *Engliſh* and *Dutch* carry on the fiſhing to a conſiderable extent; the ſeaſon at which they begin is early in the winter; and the boats in which the fiſhermen put to ſea, are of different ſizes, according to the diſtance of the place where they intend to fiſh. The veſſels uſed in the *Britiſh* Channel, called cobles, are of one ton burden, rowed with three pair of oars, and admirably conſtructed for encountering a mountain ſea. When they go out to fiſh, every perſon is provided with three lines; each man's lines are fairly coiled upon a flat oblong piece of wicker-work, the hooks being baited, and placed very regularly in the centre of the coil. Each line is furniſhed with two

* Brit. Zool. † Goldſmith's Nat. Hiſt.

two hundred and eighty hooks, at the diſtance of ſix feet two inches from each other; the hooks are faſtened to lines of twiſted horſe hair, twenty-ſeven inches in length.

When fiſhing, there are always three men in each coble, and conſequently nine of theſe lines are faſtened together, and uſed as one line, extending in length near three miles, and furniſhed with above two thouſand five hundred hooks; an anchor and buoy are fixed at the firſt end of the line, and one more at the end of each man's lines; in all, four anchors, and four buoys made of leather or cork.

The line is always laid acroſs the currents; the tides of flood and ebb continue an equal time upon our coaſt; and, where undiſturbed by winds, run each way about ſix hours; they are ſo rapid, that the fiſhermen can only ſhoot and haul their lines at the turn of the tide; and, therefore, the lines always remain upon the ground ſix hours; the ſame rapidity of tide prevents them from uſing hand lines, and, therefore, two of the people commonly wrap themſelves up in the ſail, and ſleep, while the other keeps a ſtrict look out, for fear of being run down by ſhips, and to obſerve the weather; for ſtorms often riſe ſo ſuddenly, that it is ſometimes with extreme difficulty they eſcape to the ſhore, though they leave the lines behind them.

Such is the account which M. Pennant gives * of the manner in which the taking of theſe fiſh is conducted in the channel; but there are annually larger veſſels, of twenty-five tons burden, that repair at the time of Lent to the *Dogger Bank*, where they fiſh for turbot, cod, ling, and

* Britiſh Zoology.

and ſkates; there the buſineſs is carried on in a more expeditious manner, for as the fiſhers have no occaſion to wait the returns of the tide, each man takes along with him twice the number of lines, which he continues to bait, haul, and ſhoot, without interruption.

But this method of fiſhing, operoſe as it may ſeem, and this extent of line, though it runs three miles along the bottom, is trifling when compared to the exertions made in the *Mediterranean* by the *Italian* fiſhers; there they go to ſea in a *Tartan*, a veſſel much larger than ours; and they bait a line of no leſs than twenty miles long, with above ten thouſand hooks. This line is called the *pariſina*; and the fiſhing goes by the name of *pielago* *. A piece of tackle of ſuch enormous length, it is impoſſible to hawl and ſhoot in the ſame ſpace with the *Engliſh* lines: it remains for a conſiderable ſpace in the ſea, and cannot be taken up in leſs than twenty-four hours. By this apparatus, they not only take rays, but ſharks and other fiſh; ſome of which are above a thouſand pound weight. When a fiſh of this magnitude is found at the line, the fiſhermen are provided with an harpoon to diſpatch them before they are brought on board.

* *Vide* Goldſmith.

## Section IV.

### *The Skate* *.

The ſkate is the largeſt of this genus, and thinneſt in proportion to its bulk: In theſe colder latitudes it is ſeldom found above two hundred pounds weight. *Willoughby* mentions one ſold in the market of *Cambridge*, which, when dreſſed by the cook of *St. John*'s college, dined an hundred and twenty ſtudents †.

The noſe, though not long, is ſharp pointed; above the eyes there riſes a ſet of ſhort ſpines: The whole upper part of the body is a pale brown, reſembling the wet ſand with which the animal is ſaid to cover itſelf. The body, towards the ſides, is thinned down into two fins, that have the appearance of wings; and at the buttocks there are others of a thick fleſhy ſubſtance. The tail of this ſpecies is ſhort, obtuſe, of a roundiſh form, but compreſſed a little towards the ſides ‡.

The lower part of the body is white, plentifully marked with a great number of minute black ſpots, which are ſuppoſed to be the glands, by which that ſlimy mucus which covers the fiſh is ſecreted. All fiſh covered with a ſimilar glutinous matter, are obſerved to poſſeſs the ſame organs of ſecretion §. The ſkull of the ſkate



* Raia Batis, Lin. Syſt. The Skate or Flaire, Will.

† *Vide* Ichthyol. page 71. ‡ Idem ibidem.

§ Nicolas Steno apud Willough.

is filled with a copious collection of clear glutinous matter, through which all the nerves that are diſtributed to the different parts of the body, appear tranſparent. Among theſe are ſeen the optic and olefactory nerves; the latter proceed through the apertures, all along to the noſe, and afford full proof that this animal poſſeſſes the ſenſe of ſmelling.

## *The Sharp Noſed Skate* *.

WILLOUGHBY deſcribes a fiſh of this ſpecies, which he examined at *Rome* in 1664: They are frequently taken on the *Britiſh* coaſts; and are diſtinguiſhed from the former by their long, narrow, and ſharp pointed noſe, not unlike the end of a ſpontoon †. The mouth is very large, and furniſhed with a number of ſmall ſharp teeth, bending inwards: The tail is thick, and terminates in two ſmall fins.

This is ſuppoſed to be the bos of the ancient naturaliſts, a fiſh they deſcribe as of an enormous ſize ‡. *Oppian* gives an account of its fondneſs for human fleſh, and the method it takes of deſtroying men, by overlaying them, and keeping them down with its vaſt weight, till they are drowned. Other writers give the ſame relation, and confirm the character of theſe *anthropophagi* §. In the ſouth they are ſo well known, that the perſons employed

* Raia oxyrinchus, Lin. Syſt. Idem, Willoughby.

† Pennant's Brit. Zool.

‡ Ευρυβαθος πανδεσσιν μετ ιχθυσιν· Haleut.

§ *Vide* Phile de propriet. anim. et Ulloa's voy. i. 132.

employed in the pearl fiſhing, have learned from the fatal experience of many of their own number, how much they ought to be guarded againſt. Theſe unhappy divers, are ſometimes ſurrounded, and wrapped up by the fins of the manta, for ſo this animal is there called, till they are ſuffocated: The negroes, therefore, take care never to go down without a ſharp knife to defend themſelves againſt this terible enemy.

## *The Torpedo, or Electric Ray* *.

This ſpecies inhabits our ſeas, where it grows to a large ſize, ſome weighing no leſs than eighty pounds; its colour is a dirty clay; the head and body are round, and but indiſtinctly ſeparated; the latter extremely thin, and attenuated towards the edges. Behind the eyes are two wide foramina, which *Willoughby* ſuppoſes, are intended for conveying ſound †: they are beſet with ſix cutaneous rays on their inner circumference, and communicate with the mouth.

The torpedo can live only twenty-four hours out of the ſea, and but little longer if put into freſh water; it inhabits thoſe places where the bottom is ſandy, and buries itſelf ſuperficially in it, by ſlinging the ſand over upon its back with a vibration it gives its extremities.



* Raia Torpedo, Lin. Syſt. Cramp-fiſh, Will.

† Ichthyol. page 81.

It is in this concealed ſituation that the torpedo aſtoniſhes the unwary paſſenger, who inadvertently treads upon it, by the exertion of a power perhaps the moſt extraordinary and myſterious in nature.

The narcotic power of this animal has been taken notice of in all ages *; it is ſo powerful, that when the fiſh is alive, the inſtant it is touched, it benumbs the arm, and ſometimes the whole body †. The ſame effect is produced, even when it is touched with a ſtick, or tread upon by a perſon who has his ſhoes on. *Oppian* ſtretches the matter probably too far, when he alleges that it will benumb the fiſherman through the whole length of the line and the rod ‡.

The ſhock given by this animal, moſt nearly reſembles the ſhock of an electrical machine, ſudden, tingling, and painful: It is thus deſcribed by Kempfer; "The inſtant," ſays he, "I touched it with my hand, I felt a terrible numbneſs in my arm, as far up as the ſhoulder. Thoſe who touch it with the foot, are ſeized with a ſtronger palpitation, than thoſe who apply to it the hand. This numbneſs bears no reſemblance to that which we feel when the vein has been a long time preſſed, and the foot is ſaid to be aſleep; it rather appears like a ſudden vapour, which, paſſing through the pores in an inſtant, penetrates into the very ſpring of life, from whence it diffuſes itſelf over the whole body, and gives real pain; the nerves are ſo affected, that the perſon ſtruck, imagines all the bones of his body, and particularly thoſe of the limb that received the blow, are driven out of joint; all this

* Vide Galen, Alian and Gillius. † Britiſh Zoology.
‡ Halcut.

this is accompanied with an univerſal tremor, a ſickneſs off the ſtomach, a general convulſion, and a total ſuſpenſion of the faculties of the mind: In ſhort, ſuch is the pain, that all the force of our promiſes and authority, could not prevail upon a ſeaman to undergo the ſhock a ſecond time *."

The ſubſtance which the torpedo diſcharges, and which produces effects ſo violent and inſtantaneous upon the human frame, is probably electric matter, but by what means the animal ſo ſoon collects it, no naturaliſt has been able to explain. Great as its powers are when the animal is in vigor, they are impaired as it declines in ſtrength, and totally ceaſe when it expires †; they impart no noxious qualities to the fiſh, when uſed as food; for the *French*, who find it in plenty on their coaſts, very commonly dreſs and eat it ‡. *Galen*, we are told, recommends it in epeleptic complaints, while *Rondeletius* and *Willoughby*, decidedly condemn it in all caſes, as a watery, ſoft, and fungous aliment §.

The narcotic power of the torpedo, however it may affect it as food, is ſerviceable to the animal in two important reſpects; both as a means of defence againſt voracious fiſh, and a method of procuriug ſubſiſtence from among the ſmaller tribes; the former, when electrified, are deprived of all poſſibility of ſeizing their prey; and the latter, after having unwarily approached the torpedo, and received the ſhock, are incapable of making their eſcape ||.

The food of the torpedo is ſurmulletts and plaiſe; the former is ſo ſwift, that it is impoſſible for the torpedo to take

* Kempfer's travels. † Salvianus and Willoughb. p. 82.
‡ Britiſh Zool. § Rondel de piſcib. and Willough. Ichthy l. p. 82.
|| Plinii Hiſt. Nat.

take it by purſuit: and as this fiſh has been found in its ſtomach, it juſtifies *Pliny*'s account of the manner in which this animal ſecures its prey. The torpedo is taken at *Torbay*, off *Pembroke*, and at *Waterford* in *Ireland*; it is caught with the other flat fiſh, with the trawl, and is commonly found in water forty fathom deep, in company with the congenerous rays *.

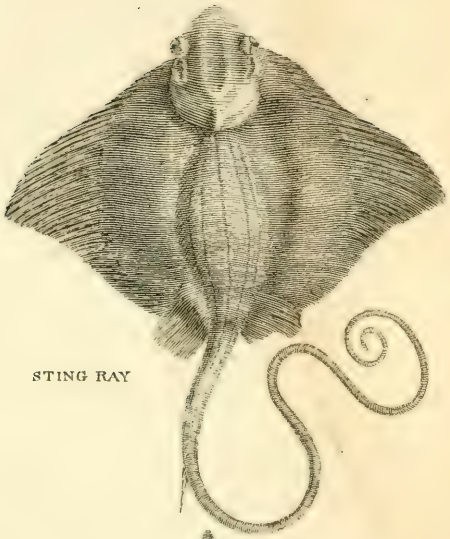
Thoſe animals are ſaid to bring forth their young about the time of the autumnal equinox †; but from a diſſection of one made by a French gentleman, they ſeem capable of ſuperfœtation, and of conſequence muſt produce young at different times. *Ronaeletius* ‡ mentions two ſpecies of the torpedo, and *Willoughby* deſcribes an *American* kind after *Margrave*, of a foot and nine inches in length, and ſeven in breadth. It is without teeth, and has two ſpiracula below the neck §.

## *The Fire-flare, or Sting* ||.

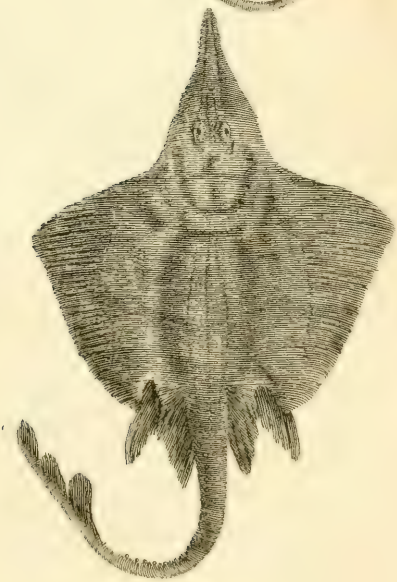
WERE we to credit all the marvellous accounts which the ancient naturaliſts have given, of the venom lodged in the armour of this fiſh, we would unavoidably dread it, as an animal ſtill more formidable than the torpedo ¶. The weapon in which nature is ſaid to have lodged this poiſon,

* Britiſh Zool. † Ariſtot. Hiſt. animal.
‡ De piſcibus. § Vide Ichthyol. p. 80.
|| Paſtinaca marina lævis, Will. La Paſtenade de mer. Belon.
¶ Pliny, Ellian, and Opiam.

Plate V.



STING RAY



LONG NOSED RAY

poiſon, grows like a ſpine from the tail; it is about five inches long, and about four inches behind the body. According to the tremendous fables of *Pliny*, it is furniſhed with a venom ſo potent, as to affect even the animal creation. Trees that are ſtruck with it, inſtantly loſe their verdure, and rocks themſelves are incapable of reſiſting this powerful *virus* *. It was with the ſpine of the trygon, or fire-flare, that the enchantreſs *Circe* armed her ſon; and with this irreſiſtible weapon, he, unintentionally, became the murderer of his father *Ulyſſes*. What a happineſs it is that theſe animals do not frequent the woods, and are ſo ſeldom ſeen aſhore!

Succeeding naturaliſts finding the taſte for the marvelous had decreaſed in their age, have been obliged to give the hiſtory of this fiſh a greater degree of veriſimilitude; curtailing it of its powers againſt inanimate nature, they have contented themſelves with making it formidable to the fiſhermen †. Their opinion has been ſanctioned by the name of Linnæus, who aſcribes poiſonous qualities to no leſs than three different fiſhes; the fire-flare, the torpedo, and the tetrodon lineatus ‡. It may be juſtly doubted, however, whether any fiſh has a ſpine charged with actual poiſon; as far as the *ſting* is concerned, we know that this is not the caſe: The ſpine is its peculiar weapon of offence, and is capable of giving a very bad wound, which being commonly inflicted on the tendonous parts of the body, and by thoſe who are conſtantly working in cold water, is ſometimes painful, and difficult to cure §.

But

* Hiſtoria animal. † Vide Geſner, Aldrovandus and Rondeletius.
‡ Syſt. Naturæ. § Brit. Zool.

But the ſpine of the fire-flare, though unattended with any poiſonous qualities, is ſtill a formidable weapon.—There is reaſon to believe, that in early times, before the uſe of iron, the ſpears and darts were headed with this bone, inſtead of that metal. The arrow of many of the South *American* tribes, are ſtill pointed with the bones of this fiſh; and from its hardneſs and ſharpneſs, it makes no contemptible weapon *.

The fire-flare, formidable as it has been deemed, is never rejected by the fiſhermen when found in his tackle; he commonly cuts away the tail, and expoſes it for ſale, deprived of this inſtrument of miſchief. This ſpecies never grows to the ſize of thoſe above deſcribed; the moſt common ſized weigh about eight or ten pounds, and are about two or three feet from the ſnout to the end of the tail †; the noſe is very ſharp at the point, but ſhort; the mouth is ſmall, and provided with granulated teeth; the eyes are protuberant; the irides of an oblong ſhape, and of the colour of gold. The whole body of the animal is ſmooth, flat below, but rounded above, and more elevated in the middle than any of the other rays ‡.

The fire-flare caſts its ſpine, and renews it annually; and that it may at no time be without a proper inſtrument of defence, it is ſometimes ſeen with the new one growing up, before the old drop off. That nothing relating to this animal might be diveſted of the marvellous, its fiſh was ſaid to have the peculiar quality of exciting concupiſcence; and when uſed in a decoction of oil, it was reckoned a cure for the leproſy: The point of its ſpine, when introduced into a diſeaſed tooth, made it ſplinter and drop from the jaw ||.

* Robertſon's Hiſt. of South America. † Will. p. 67.
‡ Brit. Zool. || Vide Geſner.

## *The Thornback* *.

THE thornback is the laſt of this genus which we ſhall particulariſe; and its figure is ſo well known, that a ſhort deſcription will ſuffice. It is of a rhomboidal ſhape, broader, however, than long, and diſtinguiſhed from all the other ſpecies of the ray, by three rows of ſpines upon the back, and five upon the tail, all pointing towards its end. The mouth is ſmall, and fitted with granulated teeth; between the noſe and the eyes are a few ſpines; others are ſcattered without any order upon the pectoral fins.

The colour of the upper part of the body is that of pale aſhes, marked with ſtreaks of black, and the ſkin rough, with ſmall tubercles like ſhagreen. The belly is white, croſſed with a ſtrong ſemilunar cartilage †. *Willoughby* has given a long detail of the internal ſtructure of this ſpecies; by which it appears, that it has two diſtinct organs, of a curious conformation, one on each ſide, for generating and excluding its eggs: In theſe are depoſited innumerable ova of various ſizes ‡; hence, the thornback muſt be very prolific. It begins to generate in the month of June, and continues production till September; its young, as long they are incapable of breeding, are called maids; they are good eating at all times of the year, but the old only begin to be in ſeaſon in the month of November.



* Raia clavata. Lin. Syſt. Idem Rondeletii et Will.
† Britiſh Zool. ‡ Ichthyol. p. 76.

The fiſhes of this ſpecies are found in great plenty, and make a conſiderable article in our fiſh markets. They are fond of devouring herring, mackrel, and eels; but their common food is probably the different kinds of ground fiſh; cruſtaceous animals, ſuch as the crab and lobſter, have been found in their ſtomachs, which are ſupplied with a powerful ſolvent, capable of ſpeedily reducing the ſhells into a chyle fit for their ſupport.

## Section V.

### Gen. VII. *The Shark.*

The fiſhes of this genus are the moſt formidable and voracious of all the tyrants of the ocean; if ſome of the rays were inveſted by the credulity of the ancients, with imaginary powers of deſtruction, thoſe poſſeſſed by the ſhark are real. The ſpine of the fire-ſlare might often prove hurtful, but the fangs of the ſhark are always fatal. The genus is diſtinguiſhed by an enormous mouth, placed beneath the head, armed both above and below, with an hundred and forty-four frightful teeth, which the animal has the power to raiſe or depreſs at pleaſure; to this hideous apparatus of deſtruction, the ſhark joins a fierceneſs and rapidity, far ſuperior to that of the other rapacious tribes: The ſmalleſt of the race is dreaded by almoſt every fiſh in the ſea; for there is hardly any of them that dread an encounter with animals far ſuperior in ſize, and more formidable in appearance. The white ſhark, which is the largeſt of this tremendous race, maintains a terrible deſpotiſm in the ocean; for, with that amazing velocity peculiar to his tribe, he unites the ſtrongeſt appetite for depredation. He approaches nearly to the ſize of the whale, but far ſurpaſſes that animal

in ſtrength and celerity, in the formidable arrangement of his teeth, and in his inſatiable deſire of plunder *.

The head and throat of the ſhark are larger than the proportion to the body, which is ſlender and tapered away almoſt to a point as it approaches the tail. The teeth are broad at the baſe, but ſlender and very ſharp above; they are diſpoſed in five rows all around each jaw, and at their inſertion are furniſhed with ſtrong muſcles, by means of which the animal raiſes or depreſſes them; when the ſhark is at reſt, they all lie flat in his mouth; but when he comes forward to lay hold of his prey, theſe dreadful inſtruments are ſuddenly raiſed, and the devoted animal, ſeized by them, inſtantly dies, pierced with an hundred wounds.

The animals of this genus have a wild and ferocious aſpect, that faithfully indicates the malignity of their nature: Their eyes are oblong, ſunk in the ſockets, and placed longitudinally in the head, where they appear almoſt overhung by the ſkin, and are full of malevolence and fire: The fins, to which they owe their rapidity of motion, are larger, and more numerous than thoſe of moſt other fiſhes: The body, though ſlender, is poſſeſſed of very ſtrong muſcles, the ſource of that aſtoniſhing impulſe communicated by the tail. The whole external parts are covered with a rough and hard ſkin, which was uſed by the ancients in poliſhing wood and ivory; but is now applied to cover inſtrument caſes, the ſkin of the greater dog fiſh furniſhing a preferable ſhagreen †.

The

* Goldſmith's Nat. Hiſt. vol. vi. 238.

† Britiſh Zoology, Claſs iv. gen. 6.

The ſhark thus fitted by his external conformation for rapin and bloodſhed, is endowed alſo by nature with a courage and activity that gives effect to his rapacious inſtincts. No fiſh, it is ſaid, can ſwim as faſt as he; none is ſo conſtantly employed in ſwimming; ſcarcely a ſhip croſſes the *Atlantic*, that is not attended by ſome of theſe rapacious monſters, for days together; and ſuch is their velocity, that they outſtrip the beſt ſailing veſſel, and play around her without any ſymptoms of exertion. With ſuch voracious appetites, and ſuch powers of gratifying them, one would imagine that theſe animals might have long ſince deſtroyed the inferior tribes, and thinned even the ocean itſelf of its inhabitants; but happily for the ſafety of the ſmaller fiſhes, theſe plunderers, by the particular ſituation of their mouths, are obliged to turn upon their ſide before they can ſeize their food; and while this evolution is performing, their prey often finds time to eſcape *.

But although the devaſtations committed by the ſhark, are thus providentially limited by the aukward ſituation of his mouth, ſtill his depredations are extenſive, and in every warm climate he is the terror of the ſailors; for of all kinds of food, he is ſaid to diſcover the ſtrongeſt predilection for human fleſh. If by any accident a ſeaman has fallen a victim to this deſtroyer, he is ſeen for ſome time afterwards hovering about the ſame place, and making ſeveral returns to the ſpot, expecting another repaſt of the ſame booty: The wake of a ſhip is a favourite reſort with theſe animals, and numberleſs are the inſtances in which accident, or the improvident raſhneſs of ſeamen, have



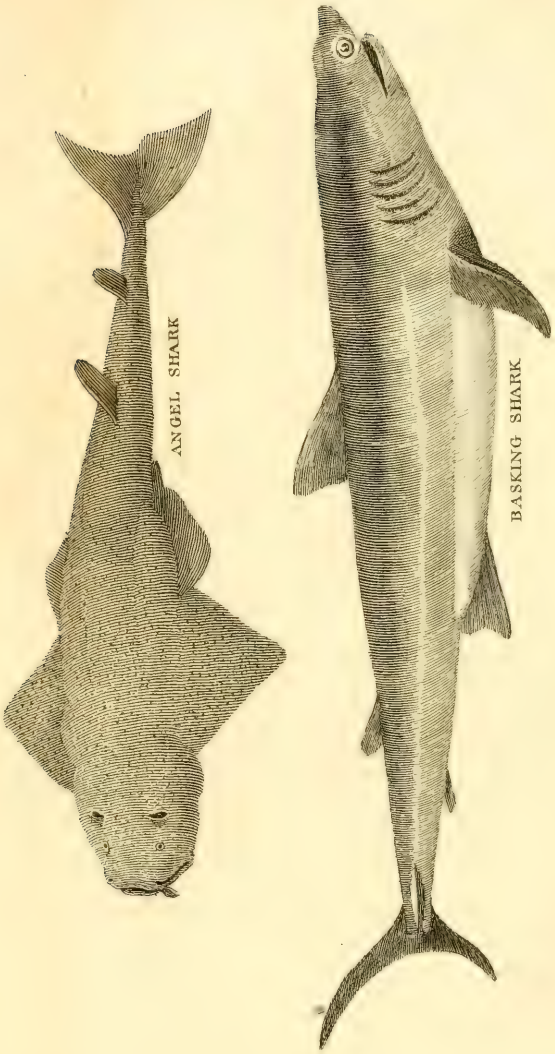
* Cod-fiſh.

have favoured their deſigns upon the human race. Along the coaſt of *Africa*, where the ſharks are numerous, many of the negroes, it is ſaid, who are obliged to fiſh for their ſuſtenance, are annually devoured by them. The inhabitants of theſe dreary regions are firmly of opinion, that the ſhark prefers the fleſh of a black man to that of a white; and that in conſequence of this unenviable diſtinction, if two perſons of different colours are both in the water together, his choice falls always upon the negro *.

Whether there be any foundation for this opinion of the negroes, it is of little importance to inquire; that the ſhark diſcovers an avidity for this ſpecies of food, is a fact that has been too often verified by fatal experience, to admit of a doubt. Mr. *Pennant* relates the ſtory of the maſter of a *Guinea* ſhip, who, finding a rage for ſuicide prevail among his ſlaves, from a notion the unhappy creatures entertained, that after death they would be reſtored to their families, their friends, and their country; to convince them, that at leaſt ſome diſgrace ſhould attend them here, ordered one of their dead bodies to be tied by the heels to a rope, and ſo let down into the ſea: Though it was drawn up again with great ſwiftneſs, yet in that ſhort ſpace the ſharks had bit off all but the feet †. *Goldſmith* tells another, occaſioned by the ſame barbarous traffic, of a woman who was thrown out alive, to deter the ſlaves from ſelf murder: When the rope was drawn to pull her up into the veſſel, part of her body appeared in circumſtances too ſhocking to be mentioned.

* Idem ibidem. † Britiſh Zoology.

Plate VI.



## Section VII.

### *The Angel**.

This fiſh poſſeſſes the character of extreme voracity, common to the ſharks and rays, two genera which nature ſeems to have intended this animal ſhould, in ſome meaſure, connect together: In its external figure, it partakes of the nature of both, while it differs from each in the ſituation of the mouth; that organ being placed in the extremity of the ſnout, and not below the head †.

The angel grows frequently to the weight of an hundred and ſixty pounds: Its body is covered over with a filthy mucus, beneath which lies a rough ſkin, employed formerly by the workmen as a ſhagreen ‡. It was from this circumſtance, that the fiſh obtained the name of *ſile* among the *Greeks* §; while the *Romans* called it *ſquatina*, from the filth with which the body is covered ‖. The colour of the back and ſides is browniſh, that of the belly white. The pectoral fins are large, and ſeem, like thoſe of the rays, to be a prolongation of the body: It was from theſe wing-like fins that this fiſh received its *Engliſh* name ¶.

The

* Squalus Squatina, Lin. Syſt. L'Ange, ou Angelot de Mer, Belon.

† Brit. Zool. ‡ Plinii. Lib. ix. Cap. 12.

§ Σεῖλ, Ariſt. Hiſt. Anim.

‖ Squatina, *Vide* Willough. page 80.

¶ Idem ibidem.

The ventral fins are placed in the ſame manner as the pectoral, and to them is annexed on each ſide the double penis, that characteriſes this and the former genus. Upon the back, and farther down than the anus, there are two dorſal fins: The tail is biturcated, the upper lobe rather larger than the under; a character belonging to all the ſharks.

This ſpecies is deſcribed by *Rondeletius* as an inhabitant of the *Mediterranean;* it is alſo ſeen frequently on the *Britiſh* coaſts, where it preys voraciouſly upon the flat fiſh that frequents the bottom of the water. The fleſh is in no requeſt, but ſeems loathed in every country, on account of its rank flavour and hardneſs: Its ova, when dried, are uſed for medicinal purpoſes, and are ſuppoſed by the *Italian* fiſhermen to be efficacious in removing a diarrhœa*. The *Turks* upon the *Barbary* coaſt, apply the ſkin in the manufacture of ſheaths for ſwords, which they are ſaid to fabricate with peculiar neatneſs †. None of the uſes, however, in which the parts of this malignant monſter are employed, ſeem capable of compenſating the dangers to which ſeamen are continually expoſed, from its voracious habits.

* Rondeletius de piſcibus. † Jovius.

## *The Baſking Shark* *.*

THIS is the largeſt animal of this genus, and differs in ſome remarkable characters from the reſt of the tribe; it inhabits chiefly the cold climates, and has long been known to the inhabitants of the weſt of *Scotland* and *Ireland*, where it is diſtinguiſhed among the ſailors by the name of the baſking ſhark, though better known in the former country by the name of the Sail-fiſh.

The latter of theſe names has been given it, becauſe it is ſeen at a diſtance on the top of the water, with all its dorſal fins appearing above the ſurface, and ſpread like ſails. Both in its manners, and external form, there are peculiarities in which it differs from the other ſharks. It is far from being either voracious or fierce: Its food conſiſts chiefly of ſea plants, no fiſh having been ever found in its bowels; but the green, and half digeſted remains of *algæ*: As its habits reſemble thoſe of the whale, *Linnæus* ſuppoſes that it is ſupported by the ſame food, aſſerting that it devours only meduſæ †.

Mr. *Pennant* has given a very accurate deſcription of this ſpecies, and ſeems firſt to have diſcovered its affinity to the ſharks, by pointing out the five tranſverſe apertures of the gills on each ſide of the neck: formerly it had been conſidered as a kind of whale ‡. The oil ariſing from their capture, is now made an article of trade in



* Squalus Maximus, Lin. Syſt. Sun-fiſh, Smith's Hiſt. of Cork.

† Syſtema Nat. ‡ Britiſh Zool. claſs iv. gen. vi.

the weſt of *Scotland*, where we have ſeen from ſix to eight barrels taken from one fiſh, though it is only the liver that produces it. They lie quiet and motionleſs on the ſurface, commonly on their bellies, but ſometimes like tired ſwimmers, upon their back; and it is in this poſture that they allow a boat to approach them, ſometimes till it is within contact, without attempting to eſcape. Then the harpooner ſtrikes his weapon into the body, as near as poſſible to the gills: But ſo inſenſible are they to the wound, that they do not feel its pain, till, by the united ſtrength of two men, the inſtrument is forced very deep into their fleſh. As ſoon as they feel themſelves wounded, they fling up their tail, and dive to the bottom. Frequently in their agonies, they coil the rope about them, attempting to diſengage the harpoon by rolling upon the ground.

Having at length diſcovered that all efforts of this kind are vain, they ſwim away with amazing rapidity, and with ſuch violence, that a veſſel of ſeventy tons has been towed after them againſt a freſh gale. They ſometimes run off with two hundred fathoms of line, and with two harpoons in them; and will employ the fiſhers for twelve, and ſometimes twenty-four hours before they are ſubdued. When killed, they are either hawled on ſhore, or, if at a diſtance from land, to the veſſel ſide; where the liver is taken out and melted into oil, in kettles provided for that purpoſe *.

The baſking ſhark is from fifteen to thirty feet in length; the colour above of a leaden colour, and below a pure white; the form of the body, like that of the ſhark kind, is ſlender and tapering. The upper jaw projects

* *Vide* Pennant ubi ſupra.

jects beyond the lower, and is rounded at the end; the mouth is placed beneath, and furniſhed with a vaſt number of ſmall teeth. The dorſal fins are placed differently from thoſe of the reſt of the genus: the firſt riſes nearer the head than the tail; the ſecond is much ſmaller, and is ſituated near the extremity. On the under part of the body there are five fins; two pectoral, two ventral, placed below the ſecond fin of the back, and a ſmall annal fin. Near theſe the male animal is provided with a double organ of generation; and between them in the female, is ſituated the pudendum. The oil produced by theſe animals, is ſaid to be preferable to every other for the manufacture of wool; and the ſkin furniſhes workmen with an excellent ſhagreen.

## *The White Shark* *.

THIS ſhark is probably the moſt ravenous and formidable of the order, and grows to the immenſe weight of four thouſand pounds †. It was in the body of one of this ſpecies that an entire corpſe was found; a circumſtance no way incredible, when we conſider their ſtrong appetite for human fleſh, and the amazing power of deglutition which an animal of this ſize muſt poſſeſs. In all hot climates, it is this ſpecies in particular that is the terror of the ſailors; it is they that conſtantly attend the ſhips,



* Squalus Carcharias, Lin. Syſt. Lamia, Plinii Hiſt. Nat.

† Gillius.

watching till ſome ſailor drop overboard, or attempt to bathe; in either caſe, the unfortunate ſeaman periſhes without redemption; for this voracious creature, will even dart up above the water to meet him in his fall.

It is in this fiſh that *Rondeletius* places the prophet *Jonas*, when he lay ſo long unhurt in bowels; and he ſays, that the language of Scripture gives no repugnance to his idea; for among the ancients all large fiſh whatever were termed whales *.

The mouth of this ſpecies is proportioned to the immenſe bulk of the animal: it is furniſhed with ſix rows of teeth, the number of which probably varies, according to the age of the fiſh. Foſſil teeth of the white ſhark are frequently dug up in *Malta*, and ſometimes in *England*: in the former country, they have been ſeen four inches long, which muſt have belonged to animals of vaſt ſize, if the proportions laid down by *Grew*, between the body and the teeth of this ſpecies, are juſt †: He aſſerts, that thoſe in the jaw of a ſhark of two yards long, are not above half an inch; the foſſil teeth found in *Malta* would, according to this calculation, belong to an animal ſixteen yards in length *Linnæus* has enumerated fifteen different ſpecies of ſharks; but if the appearances of the teeth, ſhewn in the collection of the curious, can be truſted to, he is far ſhort of their actual number; for many kinds are ſeen, of which no mention is made by him.

*Pliny*, *Oppian*, and ſeveral of the ancient naturaliſts, were acquainted with this ſpecies, whoſe mouth they juſtly deſcribe as ſituated far beneath the head, obliging the animal to turn almoſt upon its back, when it devours its

* Rondel. de piſcib. 489. † Rarities, 91.

its prey *. The eyes are large, round, and ſtaring, capable of being eaſily rolled in the ſockets. The dorſal, and pectoral fins are very large, and aid the efforts of the tail, in giving rapidity to the fiſh's motion. The tail itſelf is ſemilunar, and capable of giving the moſt dreadful ſtrokes; hence, the ſailors, as ſoon as they take one of theſe fiſhes, ſo far disarm it, by cutting off the tail.

## *The Blue Shark* †.

This ſpecies has obtained its name from the fine azure colour of the back; it is moſt frequently an inhabitant of the hot climates, where it is ſcarcely leſs formidable to ſeamen, than that immediately preceding. The body is leſs rough than thoſe of the reſt of the genus. The eyes are of an eliptical ſhape, but the irides perfectly round; behind them, there are none of thoſe foramina, which are obſerved in other ſpecies ‡.

The fiſh is of an oblong ſhape; the noſe long, ſharp, and compreſſed towards the point; the noſtrils are placed tranſverſely. Although moſt frequent in the warm climates, the blue ſhark is often ſeen on the *Britiſh* coaſts, and particularly thoſe of *Cornwall*, during the pilchard ſeaſon. It is there caught by the fiſhers, with a large kind of iron hooks, that are made for the purpoſe.

*Rondeletius*

* Supina veſcantur. Plinii. Lib. ix. cap 24.

† Squalus glaucus, Lin. Syſt. Galeus glaucus, Rondel.

‡ Willough. page 49.

*Rondeletius* aſcribes to this ſpecies, only two rows of teeth; but their number probably depends upon the fiſhes age; and if ſo, no concluſion can be drawn with regard to it, from a ſingle inſtance * : They are granulated, and of a triangular ſhape †. This naturaliſt declares, that he was an eye witneſs of the blue ſharks fondneſs for human fleſh; having ſeen one purſue a boy a conſiderable way along the ſhore, and making a ſpring at him, nearly bit of his legs.

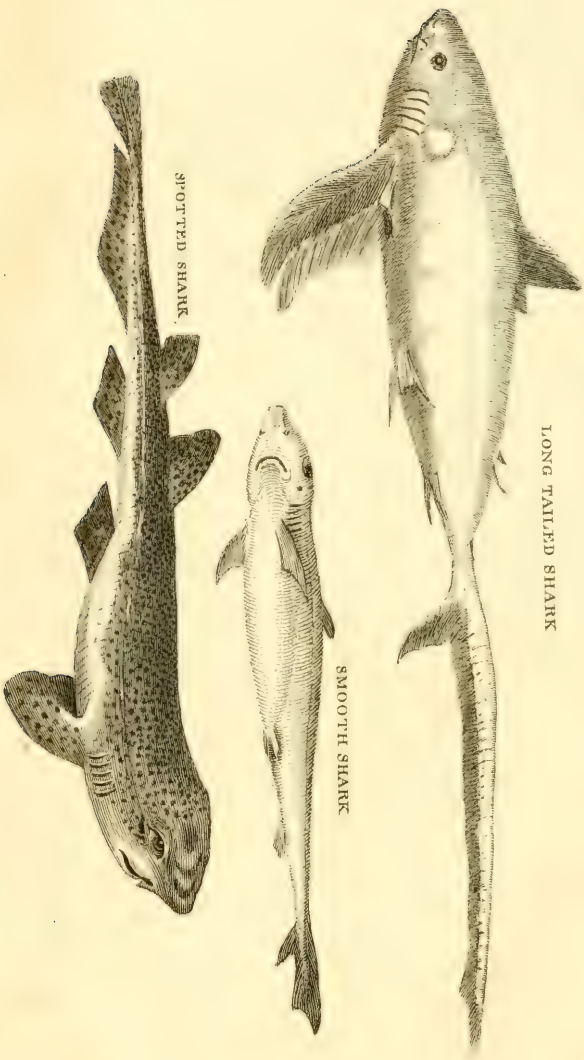
It is concerning this ſpecies, that *Ælian* relates ſuch extraordinary inſtances of parental affection ‡. It is ſaid by him, that the blue ſhark permits its ſmall brood, when in danger, to ſwim down its mouth, and take ſhelter in its belly. This fact is ſaid to have been obſerved by *Rondeletius*, an able naturaliſt; and it is narrated by *Pennant*, a very accurate ichthyologiſt, as a part of the hiſtory of this whole genus that is entitled to belief. In fact, it is no more incredible, than that the young of the *oppoſſum*, ſhould ſeek an aſſylum in the ventral pouch of its parent; a fact too well known to be conteſted §.

* De Piſcibus. † Lin. Syſt. Nat.

‡ Ælai. An. lib. i. cap. 16.

§ *Vide* Britiſh Zool. article, Blue Shark.

Plate VII.



## *The Long Tailed Shark, or Sea Ape* *.

This ſpecies has obtained its name from the extraordinary length of its tail, which generally exceeds that of the body, the upper lobe extending greatly beyond the lower, almoſt in a ſtraight line. Its fiſh has an abominable fetid, and rank ſmell, reſembling that of the land fox † The body is more thick and round than any of the ſharks; the ſnout is ſharp; and a little below is a ſmall mouth, furniſhed with pointed teeth. The colour above is cinereous, below white. *Rondeletius* aſſerts, that he was an eye witneſs of this animal allowing its young to retreat into its belly to avoid danger; for he ſaw an old one diſſected upon the ſhore, in the body of which were all its young. At firſt he imagined that they had been devoured by the parent in place of food; but upon examining them, they were all alive, and ſo entirely unhurt, that there could remain hardly any doubt of their having fled there as a refuge from danger ‡. The extraordinary length of the tails of the young, forms no objection to this fact; for at that age they are ſoft and pliant. *Willoughby* ſuppoſes that this fiſh was only found in the *Mediterranean*; it has ſince, however, been taken in the *Britiſh* ſeas §.

The

* Vulpes Marina, Rond. Sea-fox or Ape, Willough.

† Salvianus. ‡ De Piſcibus.

§ Pennant's Britiſh Zoology.

The other fiſhes of this genus that frequent our coaſts, are the *tope*, or ſea dog of the ancient naturaliſts; the greater and leſſer *ſpotted ſharks;* the *ſmooth ſhark;* the *porbeagle*, and the *picked ſhark:* Theſe all ſo nearly correſpond in their general characters to thoſe already deſcribed, that there ſeems no occaſion farther to particularize them.

## Section VI.

### Genus VIII. *The Angler.*

The fiſhes of this genus were by the ancients called ſea frogs *, from their reſemblance to that animal: The *Engliſh* have given them a ſtill more hideous name, that of ſea toads, or ſea devils; appellations which theſe animals ſeem to merit, by their extraordinary deformity. Of all the monſters contained in the ocean, they are perhaps the moſt ugly and deformed. Their head and body are joined together, forming one round flat maſs †. The head and mouth are far larger than all the reſt of the body; the latter being in ſome a yard wide, and furniſhed all around with an infinite number of ſmall teeth. The pectoral fins are broad and thick; behind each ventral fin there is one aperture.



* Βατραχος, Ariſtot. Oppian. Rana piſcatrix, Pliny and Ovid.
† Willough. Ichtchyol. page 83.

## *The Common Angler* *.

It is in its tadpole ſtate that this animal reſembles the frog: its colour upon the back is dark blue, marbled with ſome white ſpots. The lower jaw projects conſiderably beyond the upper, which gives the animal a grinning aſpect. The eyes are placed in the upper ſuperficies of the head, ſomewhat prominent, and their irides white. About half an inch from the corner of the upper jaw are two hairs, the one four, and the other ſix inches in length. It is by means of theſe, according to *Pliny*, that this animal fiſhes; it puts out theſe ſlender horns among the mud, enticing the little fiſh to play around it till they come within reach, when it ſprings upon them, and devours them †.

Around the edges of its head are ſmall fin-like appendages; outwardly there appear no apertures of the noſe, but there are two within the mouth, ſuppoſed to convey ſmell ‡. About the middle of the back there riſes a fin ſupported by ten rays; the tail is not forked, but the rays ſtretch ſomewhat beyond the membranes of the fin. The ventral fins are broad, thick, and fleſhy, jointed like arms, and on the inner ſide divided into fingers, reſembling what is ſeen on the foot of a mole §. With theſe inſtruments

2

* Lophius piſcatorius, Lin. Syſt. La Grenouille de Mer. Belon.

† Plinii, lib. ix. *Vide etiam* Cicero de Nat. Deor.

‡ Willough. ubi ſupra. § Britiſh Zool. and Willough.

inſtruments *Belon* aſſerts, that the animal walks at the bottom of the water.

Another pair of fins is placed farther out, at the verge of the body, and below there are the apertures of the gills, differing ſo conſiderably from thoſe of other fiſh, that they have been ſuppoſed by ſome, to be a retreat for the young. They are large oriſices, and at the bottom appears the branchiæ, reſembling the teeth of a comb.

Theſe fiſhes grow to an extraordinary ſize; ſome are taken near *Scarborough*, between four and five feet in length, and whoſe mouth are near three feet wide. The fiſhermen no ſooner take them, than they give them their liberty, from the ſuppoſition that they deſtroy the dog fiſh; and in ſupport of that idea, ſome of theſe voracious animals have been found in their ſtomachs.

*Willoughby* has four different ſpecies, which he has claſſed under this genus; three of which are *Brazilian* fiſhes, deſcribed by *Margrave*, the *Guacucuia*, the *Guaperua*, and the *Acaramucu*: Of theſe the *Guacucuia* or *Brazilian* water bat, reſembles our fiſhing frog, in the ſhape of its body and the fins; but differs from it in the ſmallneſs of the mouth, in wanting teeth, and in the long protuberant ſnout, that reſembles a horn. The whole body is variegated with white and black ſpots, of which the pencil, and much leſs the pen, is unable to convey any adequate idea *.



* Willough. page 89.

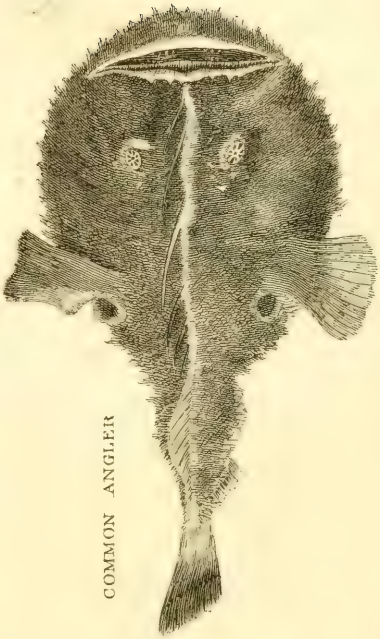
## Genus IX.—*The Sturgeon.*

The fiſhes of this genus have only one narrow aperture on each ſide; a circumſtance in which they reſemble the anglers above deſcribed. They have the mouth placed far below, tubular, and unprovided with either teeth or jaws *: Hence, theſe animals collect their food by ſuction; and notwithſtanding their ſize, which is often as large as that of the ſhark, they are the moſt peaceable and harmleſs of all animals. The ſturgeon is as unwilling, as it is incapable to injure other fiſh: It flies before the moſt feeble, and timid of the race; and not unfrequently falls a victim to its own apprehenſions and fears †.

The ſturgeons are gregarious and migratory: To the former of theſe habits, they are probably compelled by the timidity of their nature, and their incapacity for ſelf defence: all the weaker animals that are peaceable and inoffenſive, commonly truſt to their numbers for ſecurity; and hence, herd in great crowds together. The neceſſity of procuring food, of avoiding cold, or of providing a proper place for the production of their young, determines

* Britiſh Zool. † Goldſmith's Nat. Hiſt.

STURGEON



COMMON ANGLER

determines the migrations of the ſturgeon, as well as thoſe of other fiſh. During the winter months they mount the rivers; while in ſummer, they betake themſelves to the ocean; probably, however, never removing at any great diſtance from the ſhore *.

### *The Common Sturgeon* †.

RONDELETIUS, *Geſner*, and *Aldrovandus*, have tedious diſputations, whether this animal be the acipenſer, or Elops of the ancients; a matter of very little moment, ſince, if the animal be accurately deſcribed, and well known, it matters but little by what name it was anciently diſtinguiſhed.

The great reſort of the ſturgeons is the rivers of *Ruſſia* and *Germany*; and as they are frequently found in the *Mediterranean*, at the mouths of the *Italian* rivers, it is highly probable that at leaſt ſome ſpecies of them were known to the *Romans*: *Pliny*, however, as well as *Ovid*, mention the acipenſer as a foreign fiſh ‡.

The common ſturgeon is an inhabitant of the *Britiſh* ſeas, from which it aſcends the rivers, and is ſometimes taken in the nets ſet for ſalmon: It is there, however, found only in ſmall numbers; the greater part conſumed in this iſland is brought either from *North America*, or the *Baltic*. In the lakes of *Friſchehaff*, and *Curriſchaff*, and in the rivers in the neighbourhood of *Pillau*, they are

* Willough. Ichthyol.

† Acipenſer Sturio, Lin. Syſt. Acipenſer, Rondelet.

‡ Pliny, Lib. ix. cap. 17. et Ovidii Halieut.

are taken during the ſummer months in great abundance, and ſold over all *Europe* at a very high price. The ſhores in that vicinity are all divided into certain diſtricts, and let as we do the ſalmon fiſheries; ſome of them bring a rent of ſix thouſand guilders, or near three hundred pounds *per annum* *.

In theſe large rivers they are ſometimes found of two hundred pounds weight, and are taken in nets made of ſmall cords. They are dull and ſpiritleſs animals, making but ſmall reſiſtance when entangled; and as ſoon as they are brought out of the water, appear like a lifeleſs lump. Their fleſh is every where in high eſtimation; it has the delicacy, whiteneſs, and ſolidity of veal, and when roaſted, is reckoned one of the greateſt niceties that can provoke the appetite of an epicure †. It is commonly pickled, and packed up in caſks, when ſent to foreign markets: Of late, we have received a conſiderable quantity of theſe fiſh from *North America*, where they are caught in May, June, and July; it is at that ſeaſon that they are ſeen leaping above the ſurface in the rivers, and falling again upon their ſides, with a noiſe that is heard at the diſtance of ſome miles ‡.

It is of the ova of the ſturgeon that the *Ruſſians* make the caviar, by taking out the membranes found among them, and drying them, after having been waſhed with vinegar. The beſt caviar is ſaid to be afforded by a ſmall ſpecies called the ſterlet, found in the *Yaik* and *Volga* §.

Ichthyocolla or iſinglaſs is made of the ſound of this as well as the other kinds of ſturgeon ||. The ancients were acquainted

* Brit. Zool. † Will. p. 240.

‡ Cateſby Nat. Hiſt. of Carolina.

§ Strahlenberg's Hiſt. of Ruſſia, p. 337.

|| Vide Phil. Tranſ. lvii. 354.

acquainted with the compoſition of this glue, ſo uſeful in many ſpecies of manufacture: It was probably made up by them in a ſimilar manner, from a fiſh that had this very name *: It is uſeful as a glue for paper, muſical inſtruments, and cementing every ſlender fabric of wood. It is well known to the varniſher, the apothecary, and the clothier.

The ſize of the ſturgeon depends upon the place of its reſidence; where it is confined either in freſh or ſalt water, it is comparatively ſmall; but where it alternately enjoys both, it grows often to the length of eighteen feet, and weighs from four to five hundred pounds; of this magnitude one was caught in the river *Eſk*, in *Britain*; and in the larger rivers of the continent, ſome attain even to a ſuperior ſize †. The body of this fiſh is long, and of a pentagonal form, on account of five rows of large bony ſcales, which proceed from the head along as far as the dorſal fin, one upon the back, and two upon each ſide. The head is ſmall and protuberant at the ſnout; the eyes are ſmall in proportion to the fiſh, and the irides are of a ſilver grey: The mouth, without either jaws or teeth, is ſituated conſiderably below the extremity of the noſe, and in the middle ſpace between them, ſpring out a few briſtles: The firſt pair of fins are placed immediately beſide the gills; the ſecond pair near the anus, and a third between that and the tail; upon the back their is but one fin.

The ſturgeon differs from the other cartilaginous fiſhes in the manner of its generation; like the ſpinous tribes it is oviparous, and depoſits its ſpawn in the winter months ‡.

* Plinii, Lib. xxxii. cap 7. † Rondeletius.
‡ Brit. Zool.

## *The Huſo of Germany.*

THIS ſpecies is ſuppoſed to be peculiar to the rivers of *Germany*; particularly the *Danube* and thoſe ſtreams that flow into it. From the *Black Sea* it aſcends that river, and is caught in nets placed in different places to intercept it, nearly as far up as *Vienna*, where they are expoſed to ſale every Friday, to the number of ſixty or an hundred. The fleſh is ſoft, glutinous, and flabby; but it bears falting, and is exported from *Wallachia*, where it is principally taken, to the different markets of *Europe* *.

This fiſh, like the reſt of the genus, is gregarious and migratory; and it is upon its excurſions from the ſea to the freſh water, that it is taken, during the months of October and November. The huſos are from fifty to four hundred pounds weight, and are ſaid to poſſeſs ſuch ſtrength, that they frequently drive the fiſherman overboard with a ſtroke of the tail †.

It is chiefly for the iſinglaſs which it affords, that this fiſh is taken: The manner of preparing this ſubſtance, is by cutting the ſkin, the entrails and the fins, into ſmall pieces, and leaving them to macerate in a proper quantity of warm water; they are afterwards all boiled together upon a ſlow fire, until they are diſſolved and reduced to a jelly; this jelly is ſpread upon inſtruments made for the purpoſe, and upon drying it aſſumes the form of parchment;

* Geſner de Aquatil. p. 59. † Idem ibidem.

parchment; when it is rolled up, and exported in the ſhape in which we ſee it in the ſhops of the venders *.

The ſnout of this ſpecies is remarkably long, and furniſhed below with ſmall barbs; on the belly are two pair of fins, on the back one; above, the body is black; the lower parts yellow, as in the perch; the whole ſurface is deſtitute of fins, and the fleſh is ſupported by cartilages inſtead of bones †. The genuine ichthyocolla that produces the iſinglaſs is ſuppoſed by *Willoughby*, to be a different fiſh from the huſo.

* Goldſmith's Nat. Hiſt.

† Vide D. Will. apud F. Will. Ichthyol. p. 243.

## Section VII.

### Genus X.—*The Diadon.*

The cartilaginous clafs of fifhes abounds with animals of anomalous and monftrous figures, which no pen can defcribe, and which even the pencil of the artift cannot imitate; fuch are the endlefs variety of orbs, of triangular and quadrangular fifh defcribed by *Clufius*, and after him by *Willoughby* *. They are moftly exotic animals, exhibiting the rich exuberance of nature on the warmer coafts of *America*, *India*, and the *Mediterranean*. From all thefe hideous animals, the *Britifh* feas are happily free: Their utility to man cannot be difcovered; their deformity is obvious, and the venemous nature of many of them has been fo often confirmed by fatal experience, That it can no longer be doubted. From the diftance of their fituation, as well as their unattractive form, their hiftory is but little known; we fhall felect, therefore, a few only for a particular difcuffion.

* Ichthyologia, p. 143

## *The Globe* *.

THIS fiſh is ſeldom a viſitor of the *Britiſh* coaſt; one, however, of the ſpecies was taken at *Penzance* in *Cornwall*. Its more common reſidence is off the ſhores of *Carolina*. It is of an oblong ſhape, of a foot and eight inches in length; the length of the globular belly, when extended, is above one foot, and its circumference, when in that ſtate, is above two: This ſingular power of inflating its belly, till it acquires a globular ſhape of ſuch magnitude, ſeems to have been intended by Nature as the defence of this animal; it is then of a ſize leſs eaſily laid hold of by its enemies, whilſt the great number of ſpines with which its belly is ſurrounded, renders it an object of terror *.

The globe, upon the back, is of a rich deep blue; the ſides and belly are white, ſhagreened or wrinkled, and beſet with innumerable ſmall ſpines, each attached to the ſkin by four proceſſes. It has two pectoral fins; a dorſal one far back behind the globe, and oppoſite to that an anal fin.

* Tetrodon lævigatus Lin. Syſt. † Pennant. Claſs iv. gen. 9.

## *The Oblong Diadon* *.

THIS ſpecies differs from the former, not only in wanting the globe, but in being much ſhorter; it reſembles a carp, or ſome thick fiſh cut through by the middle. It ſometimes grows to a very amazing ſize; ſome have been taken five hundred pounds weight †. It is commonly little more than two feet in length; ſo that the thickneſs, to afford nearly ſuch a weight, muſt be very much diſproportioned to the animal's ſize.

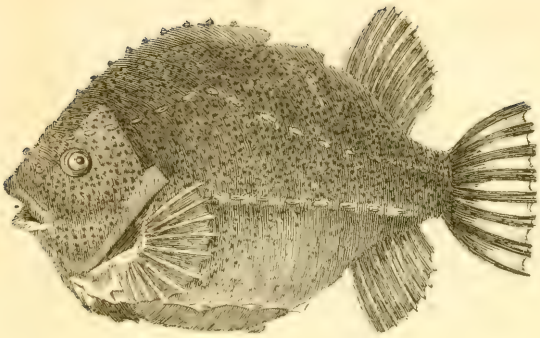
The body of this ſpecies is black above, and dappled; below it is ſilvery; it wants ſcales, but is covered with a thick, hard, and rough ſkin. The mouth is ſmall for the ſize of the fiſh; between it and the eyes there are two apertures for the noſtrils; but there are ſeveral other oriñces in the head, the uſe of which has never been aſcertained by any naturaliſt, though *Willoughby* ſuppoſes that two of them correſpond to the organs of hearing in other animals ‡.

The pectoral fins are placed immediately behind the eyes; they are ſmall, and of a roundiſh ſhape; the dorſal and the anal fins are placed high, and at the very extremity of the body; the tail fin is ſemicircular, and fills up the whole abrupt ſpace between them.

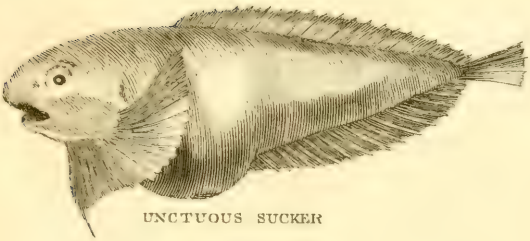
* Oſtracion Lævis, Gronovius. † Borlaſes's Hiſt. Cornwall.

‡ Ichthyologia, p. 151.

Plate IX.

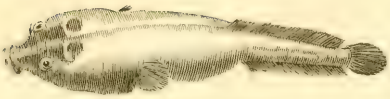


LUMP SUCKER



UNCTUOUS SUCKER

BIMACULATED SUCKER



JURÁ SUCKER

The ſhort diadon is ſtill a more aukward figure than this; it is ſhorter and thicker, having the anal and dorſal fins ſet ſtill higher, which gives the body a more abrupt appearance. The fleſh of both theſe is rank and unſavoury: When boiled, it turns into a kind of glutinous jelly, reſembling boiled ſtarch after it is cold; and from experiments made upon leather and paper, it has been found to anſwer the purpoſes of glue *. *Linnæus* has enumerated ſeven ſpecies belonging to this genus †.

* Britiſh Zoology. † Syſt. Nat. 414.

## Genus XI.—*The Sucker.*

### *The Lump* *.

This tribe contains only three ſpecies, all remarkable for the ſingular deformity of their ſhape. The body is deep and thick; the back arched, and the belly diſtinguiſhed by an oval aperture, ſurrounded with a fleſhy and muſcular ſubſtance, and edged with ſmall thready appendages, which operate as ſo many claſpers. It is by means of this appartus that theſe animals adhere with ſuch vaſt force to any ſubſtance to which they apply themſelves. The tenacity, with which the ſucker adheres to the bottom, has been tried by putting it into a pail of water, where it fixed itſelf ſo firmly, that on taking the fiſh by the tail, the whole veſſel, with its contents, were lifted from the ground, although it held ſome gallons †.

The lump ſucker, which is the largeſt of this genus, increaſes to the weight of ſeven pounds, and the length of nine inches. The back is arched and ſharp, of a blackiſh colour, dilated and variegated with brown. The belly is flat and reddiſh: it wants fins, but the whole body is defended with ſharp black tubercles. On each ſide there are three rows of large bony ſcales, and on the back

* Lumpus Anglorum, Will. † British Zoology.

back a fourth. It has two pectoral, a dorſal, and an anal fin; the eyes are covered with a lax ſkin, the irides of a pale red; the lips are thick, fat, and ruddy; the orifices of the noſe appear one on each ſide, raiſed above the ſurface of the reſt of the ſkin *.

The lump fiſh is caught on ſeveral parts of the *Britiſh* coaſts; and though its fleſh is held in no great eſtimation, it is frequently ſeen for ſale in the *London* market. The great reſort of this ſpecies, is the north ſea upon the coaſts of *Greenland*. While it prowls upon the top, the ſeals ſwarm beneath, watching an opportunity to devour it. Infinite numbers fall a prey to theſe animals, who ſwallow all but the ſkin; vaſt quantities of which, thus emptied by the ſeals, are ſeen floating above during the ſpring months, when the ſuckers approach near the land, for the purpoſe of depoſiting their ſpawn. Every diſtrict where the ſeals carry on their depredation, is eaſily diſtinguiſhed by the ſailors, on account of the ſmoothneſs of the water: Wherever any oily fiſh has been devoured below, the water at the top becomes tranquil, it being uniformly found to be a property of oil to calm the agitation of the waves †.

The inhabitants of the barren tracts of *Greenland*, who are obliged to draw a great part of their ſuſtenance from the ſea, avail themſelves alſo of this fiſh; the roe is remarkably large, and in the ſummer months they take them on account of it; when boiled, it forms an extremely fat, oily food; a kind of repaſt, of which the neceſſities of the *Greenlanders* have rendered them exceedingly fond ‡.

* Willough. page 208. † Phil. Tranſ. 1774. p. 445.
‡ Crantz's Hiſt. Greenland.

## *The Sea Snail* *.

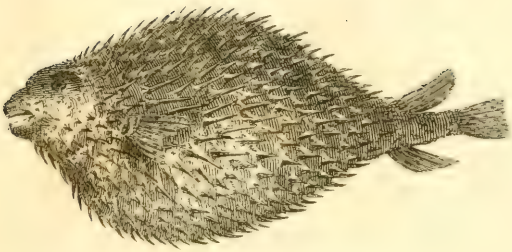
THE whole of this fiſh, the head as well as body, is ſoft and unctuous, eaſily ſoluble into a kind of oily fluid; it is on this account that it has obtained the name of ſnail. Its habitation is not properly in the ſea, but about four or five miles from the mouths of large rivers, where the water is beginning to be ſalt. The body of this ſpecies is tranſparent, of about five inches in length; and when newly taken, the colour is pale brown †.

The head is thick and round; the mouth without teeth, each jaw being only a little rough. The aperture of the gills is ſmall, covered with a valve or operculum, which ſprings from the baſe of each of the pectoral fins. Theſe fins are very broad, thin and tranſparent; and below the throat, they almoſt unite together. Below the throat, there is obſerved a round ſpot reſembling the impreſſion of a ſeal, the place which the animal applies to thoſe ſubſtances to which it means to adhere. The anal and dorſal fins continue without interruption, till, like thoſe of the eel, they meet at the tail ‡.

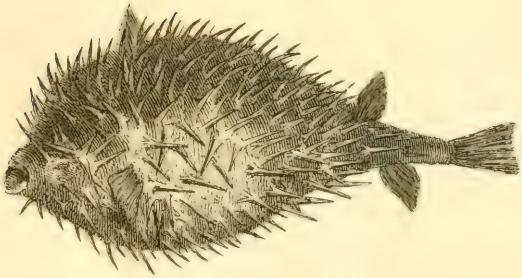
* Liparis noſtras. Will. Cyclopterus liparis. Lin. Syſt.

† Will. Append. 17. ‡ Brit. Zool.

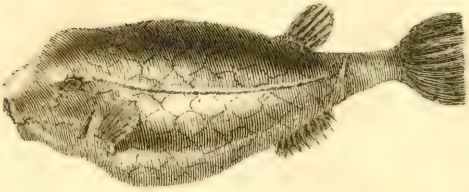
Plate X



Sea Porcupines



Ostracion



## GENUS XII.—*The Sea Porcupine* *.

THIS animal is placed among the orbs or globular fifh, by *Willoughby*; of all the inhabitants of the ſea, it is the moſt completely furniſhed by nature with defenſive armour. Inſtead of ſcales, the whole ſkin is covered with ſtrong ſharp ſpines, which are firmly inſerted into it at the baſe. Theſe are all laid flat when the animal is at reſt; but when alarmed, they all around ſtand upon end, ſo that the fiſh is inacceſſible upon every quarter. There are various kinds of theſe animals; all, however, ſeem equally poſſeſſed of the power of raiſing or depreſſing their ſpines at pleaſure, and by that means of increaſing the terror of their appearance in proportion to the approach of danger.

Together with the power of erecting their ſpines, they poſſeſs alſo that of inflating their bodies on the appearance of an enemy. This operation is performed by means of a bag within the body, which, by being filled with air, inflates the fiſh to a prodigious ſize: An animal of this tribe, that at firſt view ſeems ſmall and inoffenſive, is no ſooner alarmed or provoked, than it ſwells to the view, the whole body becoming viſibly rounder and larger; while in the mean time all its prickles ſtand upright, and threaten the invader on every ſide †. The *Americans* often amuſe themſelves with the barren pleaſure of catching theſe frightful creatures, by a line and hook baited with



* Hiſtrix, Cluſii Exot. Hiſtrix, Lin. Syſt.

† Goldſmith's Nat. Hiſt.

a piece of ſea crab: The animal approaches the hook with its ſpines flattened; but when hooked and ſtopped by the line, all its ſpears are inſtantly erected, and the whole body is armed ſo completely at all points, that it is impoſſible any where to lay hold of it; it is therefore dragged to ſome diſtance from the water, and there it quickly expires.

The body of this ſpecies is about twenty inches long, and twenty-nine in circumference round the thickeſt part. The mouth is a little prominent, and when opened, about three inches in diameter; the eyes are pretty large, and rendered horrible in their aſpect, by four ſpines riſing immediately above each of them. The two pectoral fins are about three inches long, and five broad; the dorſal and anal fins are nearly of the ſame dimenſions *.

* Vide Cluſium apud Will. p. 140.

## Genus XIII.—*Oſtracion* *.

Oſtracion is the generic name adopted by *Linnæus* for nine different kinds of anomalous fiſh which he has enumerated, all inhabitants of warm climates, and all agreeing in having the body covered with a bony coat of mail †. Some of them want horns; others have two, and ſome four: They are of various ſhapes and ſizes, and from their appearance, hardly ſeem entitled to rank with this claſs of the animal kingdom.

The ſpecies here deſcribed was ſent from the *Eaſt Indies*, and is about fifteen inches long, and four deep: The forehead appears flat, and even concave, on account of two large eye-brows that project over it; the eyes are about an inch in diameter; below them are the two ſmall foramina of the noſtrils; the mouth is hardly an inch in width, and furniſhed with very minute teeth. The body is of a quadrangular ſhape, and moved by five fins; of theſe, the two branchial are ſquare, being two inches broad by two long: Reſembling theſe, are other two ſituated near the tail, the one above and the other below; the tail fin is three inches in length, by three and a half in breadth. The whole body is covered with a cruſtaceous ſubſtance, reſembling that of the pale blooded fiſhes of that order. This cruſt is ſtrengthened and ornamented by a great

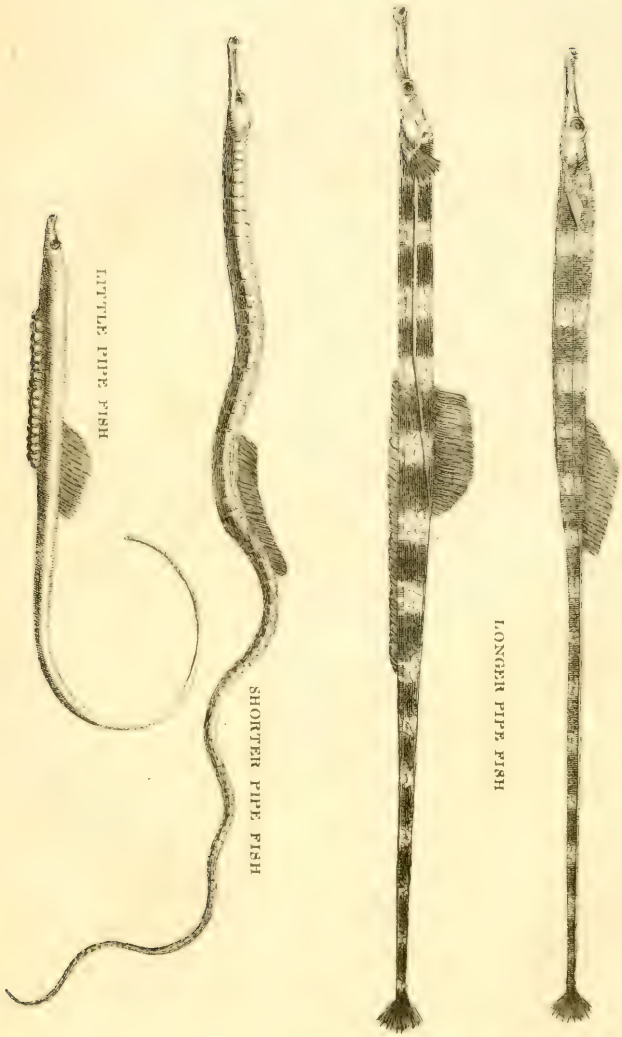


* Oſtracion prior Aldrovandi.

† Syſtema Naturæ, genus 136.

number of tubercles of triangular ſhape, and in ſubſtance is ſomething of the nature, partly of ſkin, and partly of a ſhell. There are ſome varieties of this ſpecies *. Of the orbs, or globular fiſh, *Willoughby* enumerates no leſs than thirty different ſpecies; concerning which, however, very little is known, but the name and the external figure: His orbs comprehend two or three different genera of the Syſtema Naturæ. *Linnæus* having improved the arrangement given by preceding naturaliſts.

* Will. Ichthyol. p. 148.


LITTLE PIPE FISH
SHORTER PIPE FISH
LONGER PIPE FISH

## GEN. XIV.—*The Pipe Fiſh.*

THIS genus comprehends all thoſe fiſhes that are known by the name of ſea adders, and ſea horſe: *Linnæus* has enumerated ſeven different ſpecies, of which the generic characters are, a long and tubular noſe, no orifice to the gills, but the breathing aperture ſituated on the back part of the head; the body is covered with a ſtrong cruſt; and in all, the ventral fins are wanting *.

### *The Longer Pipe Fiſh* †.

THIS ſpecies, as deſcribed by *Sir Robert Sibbald* ‡, is two feet long, the noſe an inch in length, and compreſſed laterally; at the end of it is a ſmall orifice for the mouth. The thickeſt part of the body did not exceed the circumference of a ſwan's quill; trexangular from the head to the dorſal fin, the reſt quadrangular. The belly, carinated, and marked along the middle with a duſky line §.

The

* Vide Syſtema Nat. † Syngnathus barbarus, Lin. Syſt.
‡ Scotia illuſtrata, 24. Tab. 19. § Britiſh Zool.

The colour of this ſpecies is an olive brown, marked with bluiſh lines, and, toward the tail, with brown ſpots. The pectoral fins have each twelve rays, the anal two, and the dorſal, which was two inches long, has forty. Between the vent and the tail, is a groove ſix inches and an half long, covered by two valves. This is the receptacle for the young; and as theſe animals are viviparous, on treading upon this part, hundreds of living young, are ſeen to creep out around the parent fiſh.

There are three ſpecies of the pipe fiſh found in the *Britiſh* ſeas; the longer, above deſcribed, the ſhorter, and the ſmall pipe fiſh, or ophidion of *Linnæus*. The laſt ſeldom exceeds five inches in length, is very ſlender, and tapers off to a point at the tail, having no fin there. The pectoral fins are alſo wanting, and the body is covered with a ſmooth ſkin, inſtead of the cruſt peculiar to this genus. This ſpecies is not viviparous, and conſequently the groove under the belly, does not contain living young, but eggs, which are large, and not very numerous.

## *The Hippocampus, or Sea Horſe* *.

THIS animal has obtained its name from the reſemblance its head bears to that of a horſe †: It bends the body into different curvatures, like an eel; and is marked all over with circular inciſions, reſembling thoſe of the inſect tribe.

* Hippocampus, Lin. Syſt. Cavallo Marino Italor.

† Geſner de piſcibus.

tribe. It is only nine inches in length, and often leſs, while its thickneſs is not above an inch: The ſnout is oblong, without any fiſſure at the mouth; at the lower end of which appear the foramina, with an operculum to cover them *. The body is furniſhed with acculeated knobs, and is of a pentagonal ſhape, till it reaches the anus, from which, to the tail, it is quadrangular. The eyes are round and prominent; behind them, in place of the gills, which are here wanting, there are two ſmall fins, reſembling the external ears of terreſtrial animals. Under the belly there are two orifices; one for voiding the excrement, and the other for the emiſſion of the young in their egg ſtate.

The colour of this animal is a dark green, the belly variegated with light blue ſpots. In the middle of the back riſes one dorſal fin, with ſixteen rays. Some ſpecies have hair along the back, reſembling the mane of a horſe. They are caught in different parts; that which *Willoughby* deſcribes, he ſaw at *Baiæ*, not far from *Naples*. It had no mane; he concludes, that that ornament is either characteriſtic of one of the ſexes, or of a different ſpecies. In his plates, he has given the figure of three different kinds †.

* Willough. page 157. † *Vide* Willough. Ichthyol. p. 158.

# CHAPTER VI.

## ORDER III.—*Spinous Fishes.*

### SECTION I.

### *General Characters of this Order.*

WE are now come to that order of the finny tribe, to which the later naturalists have exclusively appropriated the name of fish: According to them, the cetaceous kinds are beasts, that have taken up their abode in the ocean; and the cartilaginous, an amphibious band that are but half denizens of that element; the spinous fishes being alone entitled to that appellation *. After detailing the history of the two first orders, we have seen that there are particularities in their conformation, which, in a philosophical view, perhaps justify the arrangement of these naturalists, to whom science is much indebted. While therefore, we have availed ourselves of their method of placing the different genera, our veneration for the ideas and the language universally established among men, has induced us to rank all the inhabitants of the same element in one class, and to distinguish them by a common name.



* Goldsmith's Nat. Hist. vol. vi. page 299.

The firſt peculiarity that ſtrikes us, with regard to the fiſhes of the ſpinous order, is the greatneſs of their numbers. Not only are the individuals of each family more numerous; but the variety of the kinds is alſo far greater. Upwards of four hundred different ſpecies of ſpinous fiſhes are already known and deſcribed; while the cetaceous and cartilaginous orders, when taken together, hardly amount to a fifth of that number *. The former, are in general inferior in ſize; and it is conformable to a law, which obtains in every department of the animal kingdom, that the ſmaller the productions of nature are, the more numerous and diverſified in form does ſhe yield them. A very valuable purpoſe in the economy of providence, is gained by this conſtitution of the animal kingdom; for, ſince the ſmaller tribes are in general deſtined to become the prey of the larger, an adequate proviſion is made for the ſupply of every kind; none entirely periſhes through want; none is ultimately extirpated by depredation.

It is by the numbers, therefore, of the ſpinous fiſhes that the other orders are preſerved, and their own perpetuated. In them, as we have already obſerved, generation is performed, not by producing a living animal, or by hatching a diſtinct egg, but by ſpawning innumerable ova, that are quickened into life by the heat of the ſun, and are deſtined to ſupply the annual waſte of millions. Hence the powers of fecundity in this order, exceed belief, and in a ſhort ſpace defy calculation. A ſingle herring, if ſuffered to multiply unmoleſted, and undiminiſhed for twenty years, would ſhew a progeny greater in bulk, than the globe itſelf †. It is owing to this exube-



* Linnæus has four hunded ſpinous fiſhes.

† Goldſmith ſays above ten times greater, Nat. Hiſt. vol. vi. page 335.

rant fertility, that the herring, the pilchard, and ſome others, are obliged to migrate annually, from the artic regions, in ſhoals of ſuch vaſt extent, that for miles they are ſeen to darken the ſurface of the water.

But the amazing propagation of fiſhes, which we witneſs along our coaſts and rivers, bears no proportion to the vaſt quantities that ſwarm in the warmer latitudes of the *Indian* ocean. The inhabitants of ſome of the iſlands there, are, it is ſaid, under no neceſſity of providing inſtruments for fiſhing: As they approach the ſhore, they are found in great numbers, in the plaſhes, where the water remains after the ebbing of the tide. In ſome places where theſe ſwamps are dried up by the ſun, the fiſhes are left in ſuch ſhoals, that they communicate by their putrefaction, a noxious and unhealthy tincture to the atmoſphere.

Happily, however, for the purity of that element, and the health of thoſe beings which it ſupports in life, the waſte of theſe fiſhes is nearly proportioned to their fecundity; and the balance of nature is exactly preſerved. The ſhark, the porpeſſe, and the cod, we ought therefore to conſider not ſo much in the light of plunderers and rivals, as that of benefactors to mankind: Without their exertions, the ſea would ſoon be overcharged with the burthen of its own inhabitants; and that element, which at preſent diſtributes health and plenty to the ſhore, would in a ſhort time load it with putrefaction *.

The generation and growth of fiſhes, and particularly of the oviparous, are involved in great obſcurity. The common opinion, as we have already ſtated, is, that impregnation

* Idem ubi ſupra.

pregnation is performed without the body of the female, by the male ejecting the ſmilt, and mingling it with her ova. Something, however, like pairing and copulation, has been obſerved among the fiſh kept in ponds. At a a certain period, the ſexes are ſeen ſtruggling together among the graſs, at the brink of the water. It is then that the ſcales of ſome grow rough, and loſe their luſtre; that others grow thin, loſe their appetite, and become flabby. Should their copulation be eſtabliſhed by farther obſervation, their manner of generation would be more analogous to that of the reſt of the animal kingdom.

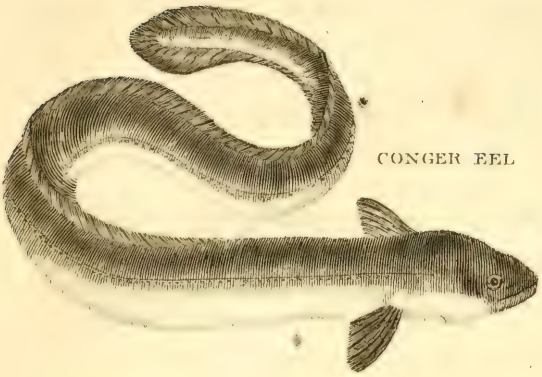
It is never yet aſcertained, whether all the fiſhes of this order, when they firſt attain to animation, and burſt from the egg, leave it perfect animals, or in a tadpole ſtate, as is the caſe with the frogs, and many of the lizards. The young frog is firſt uſhered into life, with an enormous head, and ſlender tail; but the tail ſoon after drops off, the head diminiſhes, the legs appear, and the tadpole is metamorphoſed into the quadruped, when it changes its element, as well as its form. A ſpecies of the lizard alſo, which is excluded from the ſhell without legs, acquires them by degrees, and after ſome time leaves the ſerpentine ſhape. Some fiſhes, it is probable, in like manner ſuffer a change, though too imperceptible to attract the notice of the obſerver. In ſupport of this idea, it is well known, that during the month of July, there appear in the *Thames* innumerable ſhoals of ſmall fiſh, called *white bait*, that are univerſally allowed to be the young of ſome ſpecies abounding there. They have no roe; a circumſtance which proves them to be young: they reſemble no other fiſh exactly; from

which the concluſion is, that they undergo a change before they arrive at maturity.

The general character by which naturaliſts diſtinguiſh the ſpinous fiſhes from every other, is that bony operculum, which, in this order, univerſally covers the gills on each ſide. By theſe coverings, the gills are alternately opened and ſhut; and the ſpinous fiſhes breathe by theſe organs alone, without any aſſiſtance from lungs. Hence, as theſe animals partake leſs of the conformation of quadrupeds, than the two orders which we have already examined, ſo they can in general remain a ſhorter time out of their proper element: When taken from the water, they teſtify their ſuffering, by panting more violently, and at cloſer intervals; the thin air furniſhes not their gills with proper play, and in a few minutes they expire.

But the ſpinous tribes are not all equally incapable of ſupporting life in the open air; ſome are tenacious of it, even in that element. The eel will live ſeveral hours out of water; and the carp has been known to be fattened in a damp cellar. The manner in which this proceſs is conducted, is by putting the animal in a net, wrapt up in wet moſs, the mouth only diſengaged, for the convenience of feeding: The nouriſhment with which it beſt agrees, is white bread and milk; and upon this food it will fatten more rapidly, and become better flavoured than when fed in the pond. It is neceſſary, however, that the net be dipped frequently in water, and kept hanging in a damp vault. From this experiment, it would appear, that the want of moiſture to the gills, is the cauſe of death in theſe animals; and could that be ſupplied, the vital functions might be carried on nearly as well in the one element, as in the other.

Plate XII.



CONGER EEL

EELS

## Division I. *Of Apodal Fiſhes.*

### Section II.

### Genus XV. *The Eel.*

In forming this genus, nature ſeems to have made a near approach to the reptile tribes; like theſe animals, the body is long, ſlender, and flexible. Excepting the ſmall pair of pectoral, it may be ſaid to have no fins; for the dorſal, anal and tail fins are united in one web, which ſurrounds a large portion of the body. The apertures to the gills are ſmall, and placed behind the pectoral fins: they are covered by ten branchioſtegous rays.

The eel differs from almoſt every other fiſh of that order, of which it is placed at the top, in the manner of its generation. It is viviparous, and is impregnated in the ſame manner which obtains among the cartilaginous tribes. The ancients entertained very extravagant notions concerning the generation of theſe animals. *Ariſtotle* aſſerted, that they were neither male nor female, had no ova nor ſemen *. Hence it was believed that they ſprung from the mud, or that the incruſtations ſcraped from

* *Vide* Hiſt. Animals.

from their bodies by the ſtones, received animation. *Rondeletius* raſhly adopted this opinion, from having obſerved that they were generated in pools, from which all the mud and water had been for a while extracted *. This was a phenomenon, for which they could in no other way account, than by the ſpontaneous generation of eels: But later obſervations have aſcertained, that ponds are often ſupplied with theſe fiſh, in the ſame manner that vegetation is ſpread, by tranſporting the ſeeds of plants. The heron, or other water fowl, may drop the eel, when carrying it to its young, or the young may be ejected unhurt from its bowels, as the ſeeds of plants are voided by land birds, without being injured by the operation of the ſtomach.

In their habitation, the fiſhes of this genus are ſtill more ſingular, than in their manner of propagating their young. They can reſide either in ſalt or freſh water †; and what is ſtill more ſurpriſing, they are in ſome meaſure independent of either; for they ſometimes leave their native element, and wander, during night, along the dewy meadows, not only for a change of habitation, but in queſt of prey ‡. Of theſe nightly excurſions, the ſnail is commonly the victim, being devoured by the eel as it paſſes along.

There is no animal more vivacious than the eel; when drawn from the water, it will ſurvive blows that would have killed an animal ten times its ſize; and even after it is cut aſunder, the different parts are ſeen to move §. It is, however, ſo eaſily deſtroyed by cold, that to avoid it, it beds itſelf deep among the mud, and continues, like the

* De piſcibus.

† Rondelet. de Piſcibus. 199.

‡ Brit. Zool. claſs iv. gen. 12.

§ Idem ibidem.

the ſerpent tribe, in a torpid ſtate during winter. Some have been known to take ſhelter under a rick of hay in ſevere weather, and even there, have all periſhed from exceſs of cold *. Though fond of hiding themſelves in the mud, they are incapable of living in thick turbid water; and hence, when a river is diſturbed by a flood, they are frequently ſuffocated by the impurity of the ſtream †.

## *The Common Eel* ‡.

THE external figure of this fiſh is too well known to require a minute deſcription. The body is long, round, and tapering, compreſſed towards the tail, and above of a blue colour, tending to yellow on the belly. The river eel has no ſcales, the body being all over lubricated with a viſcous ſubſtance, ſerving at once to protect the animal from cold, and external injury. Thoſe which are fed in pure running water, are brighter in their colour, as well as more delicate in their fleſh §.

The irides are white, and near the eyes, are ſeen the orifices of ſmell. The branchiæ are four in number, covered with a ſkin, and extremely ſmall: the aperture externally communicating with them, is ſo minute, that it occaſions their ſuffocation in muddy water, and is probably the cauſe why they are capable of living ſo long in the open air ||.

There

* Albertus apud Geſner, page 45. † Willough. page 110.
‡ Muræna Anguilla, Lin. Syſt. Anguilla Plinii, lib. ix.
§ Idem ibidem. || Rondelet. de piſcib. lib. 1. cap. 9.

There are ſeveral varieties of the common eel, probably occaſioned by the different food on which they are ſupported. Theſe animals are all extremely voracious; they devour carrion or any putrid ſubſtance that falls in the way *: They are capable of ſubſiſting equally in freſh water, or in ſalt, and thrive either in a ſtream or in a pond, and even in wells †; but though a fiſh almoſt univerſal, naturaliſts ſeem agreed, that there are none in the *Danube*, nor in any of thoſe ſtreams which flow into it; while they are found in all the branches of the *Rhine* ‡.

This ſpecies often grows to a pretty large ſize, ſome weighing ſeventeen pounds; there is indeed an inferior kind in the *Thames*, and about *Oxford*, which neither attain to the ſame ſize nor fatneſs; they are known by the largeneſs of the head, and the roundneſs of the ſnout, and have there received the appellation of grigs. Every ſpecies of the eel was deemed among the *Romans* contemptible food, according to *Juvenal*, from their foul feeding, and their reſemblance to a ſnake.

## *The Conger Eel* §.

THIS often grows to an enormous ſize; ſome are taken eighteen inches in circumference, and ten feet long, weighing

* Brit. Zool. † Rond. ubi ſupra. ‡ Albertus.

§ Muraena Conger, Lin. Syſt. Le Congre, Belon.

weighing upwards of an hundred pounds. A fiſhery of congers eſtabliſhed at *Mount's Bay*, in *Cornwall*, forms a very conſiderable article of commerce. They are annually exported to *Spain* and *Portugal* in a dried ſtate, where they are grinded down into a kind of powder, and are uſed in enriching their ſoups *.

They are caught by a ſort of line called a bulter, baited with pilchards; when taken, they are ſlit up, that a part of the fat may exude from them before they are ſalted, and fit for uſe; and ſo conſiderable is the quantity of juice that thus eſcapes, that a fiſh of a hundred weight will not dry to above twenty-five pounds. M. *Pennant* ſuppoſes that a fiſhery of congers might be eſtabliſhed with advantage in the *Hebrides*, could the averſion of the natives to this tribe be overcome.

This ſpecies is diſtinguiſhed by the ſame voracity as the former; it devours other fiſh, crabs, and even carcaſes. The mode of its generation is probably the ſame with the common eels; but, however this be, it is certainly prolific, for the number of its young that annually aſcends the *Severn* is prodigious; they are there called elvers, and during the month of April they ſwarm in ſuch ſhoals, that they are thrown out upon the ſhore with ſmall ſieves made of hair, and fixed to the end of a pole; a man will in this manner take out as many at one tide, as will fill a buſhel †.

The conger differs from the common eel, in having the eyes larger in proportion; the irides of a bright ſilvery colour, the lateral line marked with a row of ſmall ſpots; the edges of the dorſal and anal fin black, and in having a greater number of bones.

* Brit. Zool. † Vide Geſner, apud Will.

## *The Sea Serpent* *.

This hideous animal may be referred to the genus of eels, which in its external figure, it nearly reſembles. It is generally about five feet in length, ſlender, and almoſt entirely of the ſame thickneſs, till near the tail, where it tapers off in a ſmall point. The upper part of the body is of a dirty yellow, the under, bright blue. The ſnout is long, ſlender, and prominent, divided by a frightful mouth; armed on the inner parts with ſmall teeth, eight or nine of a larger ſize being placed before, and on the middle of the palate. The eyes are ſmall, of an oblong ſhape, placed obliquely in the direction of the body, the irides of a gold colour, interſperſed with brown ſpots. This ſpecies has only two pair of fins, inſerted near the gills, and ſtrengthened by ſixteen cartilaginous rays. There are two ſpotted lines, ariſing from a common point on the back part of the head, and ſtretching in a parallel direction along the ſides, till they terminate about two inches from the extremity of the tail. The tail is not compreſſed as in the eels, but round, and fimbriated, with no fins; neither the anal nor dorſal reaching to its extremity †.

There are ſeveral other kinds of ſea-ſerpents, ſome ſpotted, and others red; but as theſe are moſtly foreign fiſhes,

* Serpens Marinus. Rondel. Sea ſerpent, Will. 107.

† Willough. page 108.

fiſhes, whoſe hiſtory is altogether unknown, we forbear to enumerate them, and to tire the reader with the barren and uninſtructive diſcription of their forms *. One ſpecies, however, of the eel tribe deſerves our notice, becauſe it has been found to poſſeſs the ſame narcotic powers as the torpedo; it is the gymnotus electricus of *Linnæus*, called by the *Engliſh* of *Jamaica*, the torporific eel: This ſingular fiſh is only found in the interior parts of *South America*, particularly in the lakes of *Surinam*, from whence it has been tranſported to *Jamaica*. Different attempts have been made to introduce it into *Europe*, but without ſucceſs. If touched with the hand, it communicates a ſtrong ſhock to the arm; and the ſame effect is produced by applying it to a metallic rod, whereas it is harmleſs when touched with a piece of wood. From theſe experiments it appears certain, that the matter diſcharged by the torporific eel, partakes of the nature of the electric fluid. The tribe of gymnoti in which *Linnæus* places this animal, comprehends five different ſpecies; of the eels, properly ſo called, he enumerates only ſeven kinds †.

* Vide Rondel. et Aldrovand. † Vide Syſt. Nat.

## Section III.

### Genus XVI.—*The Sea Wolf**.

This voracious fiſh inhabits the northern parts of the ocean; it is found on the coaſts of *Ireland* †, *Greenland*, and *Norway*, but ſeldom ventures farther ſouth than thoſe parts of the *German Ocean* which waſh the ſhores of *Britain* ‡ and *Holland*. The back, fins, and ſides, are of an azure hue; towards the belly it is white, and the whole ſkin is ſmooth §.

What particularly diſtinguiſhes this animal, is its large mouth, and formidable teeth; the fore teeth are ten or twelve in number upon each jaw, round, conic and ſharp; behind theſe are the grinders, round and flat, about twenty-four in number; upon the bones of the palate are three rows of ſimilar teeth. There is no fiſh ſeems more completely armed for devaſtation than the ſea-wolf, and none more willing to uſe the inſtruments with which nature has ſupplied it; it will gnaw even the anchor of a ſhip, ſo that the noiſe is heard above; the marks of its teeth are plainly diſcernible on weighing it up ‖.

The

* Anarhicas Lupus. Lin. Syſt. Cat-fiſh, Sibbald.
† It is there called Steinbeiſſer, ‡ Schonf. 45.
§ Brit. Zool. Claſs iv. gen. 13. ‖ Will. p. 130.

The teeth of this fiſh are frequently dug up in a petrified ſtate, where they are called bufonites, or toad-ſtones; formerly they were much eſteemed for their imaginary virtues; they were ſometimes ſet in gold, and worn as jewels *; the teeth of three large fiſhes of this ſpecies, were ſeen at *Scarborough*, every one of which were either broken or disfigured by the hard ſubſtances which theſe animals had attempted to macerate †.

Both the dorſal and anal fins of this fiſh extend almoſt to the tail, which is round at the end, and ſtrengthened by fourteen rays; the pectoral fins reſemble two ſmall wings, being about five inches long, by ſeven broad. The food of the wolf fiſh is cruſtaceous fiſhes, the ſhells of which it can eaſily comminute. Theſe animals are oviparous; and their young, for ſome time after their production from the egg, are of a greeniſh caſt, reſembling the ſea weeds among which they then reſide; ſome of them have been caught in the *Frith* of *Forth*.

* Britiſh Zool. † Willough. p. 130.

## GENUS XVII.—*The Sand-Eel, or Lance**.

THESE fiſhes ſomewhat reſemble the eel in their external form, as their name imports. They are dug or hooked up from the ſand in the ſhallow pools that are left by the reflux of the tide, commonly for bait, though they are themſelves reckoned delicate food. The ſand-eel has frequently been found in conſiderable quantity in the belly of the porpeſſe, which confirms the account we gave of that animal digging up the ſand in ſearching for its prey. *Linnæus* has only one ſpecies belonging to this genus, that which we frequently ſee dug up along our ſhores.

The body is nearly a foot long, of a ſquare form, but rounded towards the ſides, which are divided, each by a ſtrait line proceeding from the head, and terminating in the tail; the lower jaw projects beyond the upper, and when extended, the gape of the animal is very wide; there are no teeth, the long ſharp tongue moving in a mouth entirely ſmooth; the pectoral fins are placed near the gills; the dorſal and the anal fins are ſupported by numerous rays, and proceed nearly as far back as the tail †.

* Ammodytes Tobianus. Lin. Syſt. Ammodytes Geſneri

† Willough. p. 114.

## Genus XVIII.—*The Ophidium* *

The fiſhes of this genus are two; the one has a number of barbs hanging over from the lower jaw, while the other wants theſe, but in all other reſpects appears the ſame. The ophidium has a great reſemblance, in ſhape, to ſome of the tribe of eels, but is of inferior ſize. *Belonius* aſſerts that thoſe in the *Mediterranean* are not above a handbreadth. The back is cinereous; the ſides of a ſilver colour: There are no ſcales, but in their place a number of oblong ſpots here and there diſperſed over the body; the mouth is large, and exaſperated with a number of ſmall teeth round the palate and jaws; the eyes are large, covered with a pellucid membrane: There is only one pair of fins near the branchiæ; the dorſal fin takes its riſe not far behind the head, from whence it proceeds along the back, ſurrounds the tail, and terminates below at the anus. The body is exactly divided by a lateral line, which extends along each ſide from the head to the tail †.

* Ophidion Plinii. Ophidium, Guan.

† *Vide* Guan. Hiſt. Piſcium, p. 117.

## GEN. XIX.—*The Stromateus* *.

*LINNÆUS* enumerates two ſpecies under this genus, the fiatola and the parda †. The characters are, a round flat body, covered with a ſmooth glutinous ſkin, and deſtitute of ſcales ‡. The ſize of the fiatola or lampuga, as it is called by the fiſhermen of *Rome*, is nearly a foot, and its weight a pound and an half; the colour of the upper part of the body is pale azure, that of the belly ſilver; the whole beautifully ornamented with yellow ſpots; upon each ſide are two lines, the one ſtraight, and the other incurvated like a bow §; the ſnout is flat, the mouth ſmall, and the tongue ſmooth, fleſhy, broad, and moveable; the eyes are ſmall, and covered with the common membrane that ſurrounds the head; the pectoral fins are furniſhed with a great number of rays, and the ventral are wholly wanting; the dorſal fin riſes about a third part of the total length from the head, is ſupported by forty-ſix cartilaginous rays, and is prolonged till within leſs than an inch of the tail; the anal fin nearly reſembles it in ſhape, and takes its riſe ſtill nearer to the tail.

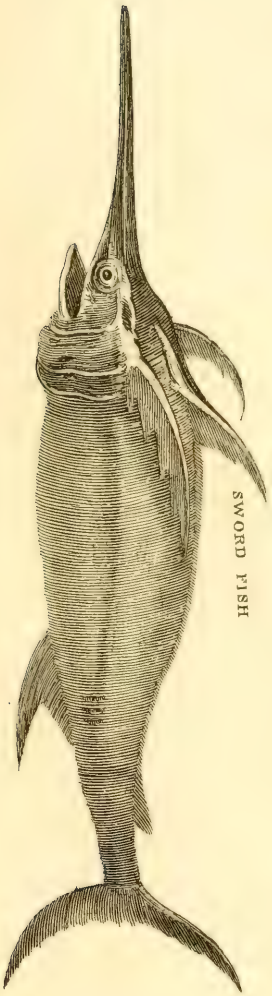
*Willoughby* obſerved theſe fiſhes expoſed in the markets in different parts of *Italy*, where they are reckoned moſt delicate food, and bring a high price; none of them have yet been found in the *Britiſh* ſeas.

* Stromateus, Rondel. Callichthys, Belon.

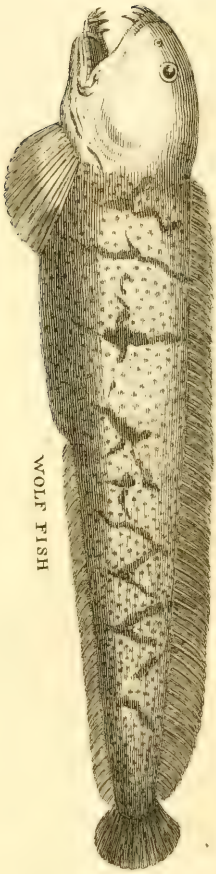
† Syſt. Nat. 169. Will. p. 156.

‡ F. Guan. Hiſt. Piſcium. p. 173.

Plate XIII.



SWORD FISH



WOLF FISH

## Genus XX.—*The Sword-Fiſh* *.

Of this genus there is only one ſpecies, which on that account is allowed to retain the generic name of ſword-fiſh, an appellation given this animal almoſt in every country, and evidently derived from the peculiar conformation of the upper jaw; it projects about four times the length of the lower one †, is compreſſed at the top and bottom, and ſharpened towards the point. This enormous ſnout is three feet long, reſembling a ſword in ſhape; its ſubſtance is rough and hard, but by no means capable of piercing and ſinking veſſels in the ſea, as is aſſerted by *Pliny* ‡.

The ſword fiſh grows to a large ſize, the head alone, being in ſome inſtances known to weigh upwards of ſeventy pounds §. The body is long and ſlender, thick towards the head, but tapering off into a ſmall ſize as it approaches the tail: The colour above is black, and on the belly of a ſilvery white: The mouth is without teeth; the lower jaw terminates like the upper one, in a ſharp ſpear-like point, but is greatly inferior in length: The dorſal fin takes its riſe above the gills, and continues till it nearly reaches the tail; it is ſupported by twenty-ſix rays; the firſt of which is by far the ſtrongeſt and higheſt, the



* Xiphias Gladius, Lin. Syſt. L'Heron de Mer. Belon.

† Will. p. 161.

‡ Roſtro mucronata eſſe, ab hoc naves perfoſſas mergi in oceano. Lib. 32

§ Brit. Zool. Claſs iv. gen. 16.

other gradually diminiſhing, till the four laſt, which again riſe higher, and give the appearance of a ſecond fin. The tail branches into forks, exactly reſembling a creſcent: There are on each ſide, a little above the tail, two triangular protuberances, formed by the ſkin, reſembling the ſpurious fins of the tunny: the pectoral fins are placed at the gills; the firſt ray of theſe is alſo by far the longeſt, which gives them the appearance of a ſcythe. The anus is placed about one third part of the body from the tail, and below it are two anal fins connected by a common membrane. The ſword-fiſh is exceedingly voracious, and is a great enemy of the tunny, which diſcovers its fear as ſoon as it approaches. *Ovid* and *Belon* take notice of its hoſtilities againſt this timid prey *.

The ſword-fiſh ſometimes frequents the *Britiſh* ſeas, but is much more common in the *Mediterranean*; the *Straits* of *Meſſina* are particularly famous for it; and it was probably upon a promontory there, that the *ſpeculatores*, or perſons employed to watch and give notice of its approach, were ſtationed. *Willoughby* informs us that he went himſelf to *Scylla* to be a ſpectator of the *Italian* method of killing this animal: The ſpies above, on ſeeing the ſword, make ſignals to the boats below, directing the ſailors where to ſteer: As ſoon as the veſſel reaches the ſpot where the fiſhes are, one of the moſt ſkilful of the fiſhermen gets upon a maſt, erected for the purpoſe, and directs the boat till it comes within reach of the particular fiſh at which he intends to aim; he then comes down

* Ac durus Xiphius, ictu non mitior enſis;
Et pavidi magno fugientes agmine Thunni. Halieut. 97.

down and pierces it with a ſpear; this inſtrument being faſtened to a rope, the animal is allowed to ſtruggle till it is overcome with fatigue and pain, when it is either taken up into the veſſel, or drawn aſhore, according to the ſize of the fiſh *.

The fleſh of this animal is whiter than that of the tunny, nouriſhing and not unpleaſant in its flavour. The inhabitants of *Sicily* reckon it one of the firſt delicacies, equal to the ſturgeon, and purchaſe it frequently at the price of ſixpence the *Engliſh* pound †.

There is another fiſh nearly allied to the above, which is peculiar to the *American* ſeas, and called by the *Braſilians* guebucu ‡. The ſnout is ſharp, bony and hard; its length is ſixteen inches, the lower jaw reaching above one half of that ſpace. The length of this ſpecies is four feet, and its thickneſs one; it is diſtinguiſhed by two remarkable long bony ſubſtances, reſembling a rod, in the place of its ventral fins, which it has the power of folding down into a kind of furrow made in the belly for their reception; the dorſal fin is three feet long, and capable of being hid in the ſame manner.

* Vide Strabo. Lib. i. apud Will.

† Willough. page 163. ‡ Idem ubi ſupra.

## Division II.—*Jugular Fiſhes.*

### Genus XXI.—*The Dragonet.* *

There are three kinds of the dragonet enumerated in the ſyſtem of nature, the lyra or gemmeous, the dracunculus or ſordid, and the *Indian*: They are all deſtitute of ſcales; and are of a ſmooth, uniform body, attenuated towards the tail. The mouth is very ſmall, thickly ſet with teeth, upon the jaws, tongue and palate †. The eyes are prominent, ſomewhat large, placed vertically, and near to each other; hence the name of *ouranoſcopi*, which theſe animals have obtained from the old naturaliſts ‡. The upper lip is in this genus double; and it is alſo diſtinguiſhed by a three forked ſpine, riſing from each of the *opercula* of the gills, and lying backwards along the head.

The gemmeous dragonet, is found as far north as *Norway* and *Spitzbergen*, and ſouth as far as the *Mediterranean*: it is not unfrequently upon the *Scarborough* coaſts, where it is taken by the hook in thirty or forty fathoms water. It grows to the length of ten or twelve inches, and is often

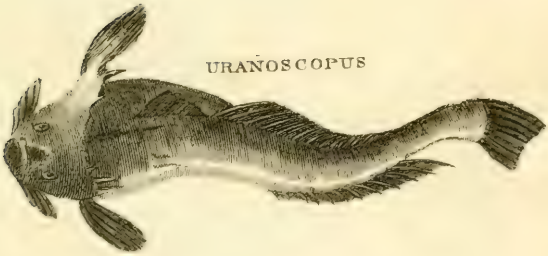
* Callionymus Lyra, Lin. Syſt. Yellow Gurnard, Phil. Tranſ. No. 29.

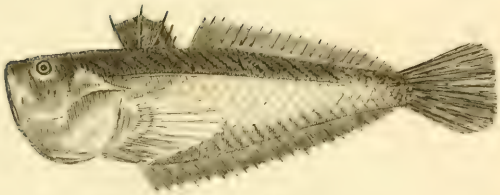
† Gunn. Hiſt. Piſc. 121. ‡ *Vide* Gronov. Zooph. No. 206.

Plate XIV.

DRAGONET

URANOSCOPUS





COMMON WEEVER

often found in the ſtomach of the cod-fiſh. It breathes in the manner of the cetaceous fiſhes, by means of two orifices in the crown of the head, through which it forces the water received by the mouth *.

The ventral fins are jugular, and placed before the pectoral, a circumſtance by which all the fiſh of this diviſion are diſtinguiſhed; they are placed at a diſtance from each other, are broad, and of one piece. The pectoral fins are round, of a light brown colour, the rays aculeated, and extending beyond the membrane that connects them like launces. The dorſal fins are two; the firſt of a form ſo ſingular, that it at once diſtinguiſhes this ſpecies from every other. The firſt ray is cetaceous, and extends in a curvated direction, almoſt as far as the tail. The rays of the ſecond dorſal fin are of an equal length, except the laſt, which extends a conſiderable way beyond the reſt: The anal fin is placed exactly oppoſite to it, and reſembles it very nearly, both in ſhape and ſize.

The tail of this ſpecies is long, rounded, and ſupported by ten rays. It has obtained the name of the gemmeous dragonet, from the variety and brilliancy of its colours: When taken out of the water, the yellow, the white, and rich cærulean blue, with which it ſparkles, make a fine appearance; the laſt colour in particular glows with inexpreſſible ſplendour.

The ſordid dragonet is inferior in ſize, as well as beauty; being only about ſix inches in length; and about two in thickneſs. It is of an olive colour above, and white below, The ſides are marbled with ſmall ſpots of ſilvery

* Brit. Zool. claſs iv. gen. 17.

ſilvery blue; and upon the top of the head is a triangular ſpot of a purpliſh colour. It frequents the *Britiſh* ſeas but rarely; *Willoughby*, however, aſſerts that it is frequently ſeen in the fiſh markets of *Rome* and *Genoa*: Its fleſh reſembles that of the bull-head, and its manner of feeding is the ſame.

## Genus XXII. *The Uranoſcopus* *.

Of this genus there is but one ſpecies, a fiſh about nine inches in length, with a large, flat, and circular head. The lower jaw projects beyond the upper, and is turned upwards at the end; the eyes are ſmall, prominent, and almoſt contiguous. The face is flat, and has the appearance of conſtantly ſtaring upwards. Both the jaws are armed with ſharp teeth, as is alſo the palate and whole inſide of the mouth. The whole face, but particularly the covers of the gills, are rough and unequal with tubercles, the baſes of which are ſurrounded with ſpines; and at the extremity of each of the opercula, where the head unites with the body, there are two pointing backwards, remarkably ſharp and large. The uranoſcopus has two dorſal fins; that neareſt the head is ſmall, of a black colour, and ſupported by three ſharp rays: The ſecond is higher and broader, and contains fourteen rays: The ventral fins in this ſpecies are placed far before the pectoral, and ſeem directly under the eyes: It is frequently caught in the *Mediterranean*, and is ſaid to be a delicious morſel †.

* Trachinus, Artedi Uranoſcopus. Aldrov.

† Geſner de piſcib.

## Genus XXIII. *The Weever* *.

There are ſeveral ſpecies of this genus found on the *Britiſh* coaſts, although *Linnæus* only mentions one, the draco, a fiſh of along and compreſſed figure, marked upon the ſides by a number of cinereous lines, that ariſe from the middle of the back, and proceed along the ſides towards the belly. The two lateral lines that extend from the gills to the tail, are placed much nearer the back than thoſe of any other fiſh. The *branchiæ* are yellow, the belly white, and the whole body is covered with ſmall thin ſcales. The eyes are placed remarkably near to the ſnout; the irides are yellow, punctuated with black ſpots. The lower jaw projects beyond the upper; both armed with ſmall teeth. The apertures of the gills are uncommonly large, and each of the covers is furniſhed upon the upper angle, with a ſtrong ſharp ſpine. The dorſal fins are two; the firſt conſiſting of five ſharp prickly rays; the ſecond is ſupported only by cartilaginous rays, and is prolonged almoſt to the tail. The pectoral fins are ſituated lower than uſual; the ventral fins are jugular, each ſtrengthened by ſix rays. The anus is not far from the throat; and from it to the tail, there proceeds a long fin fortified by thirty-two rays, which project beyond the membrane that connects them †.

The

* Trachinus Draco, Lin. Syſt. Draco Marinus, Plinii.

† *Vide* Willough. page 288.

The weever is frequent in the *Mediterranean*, where it grows from ten to fifteen feet in length; it is capable of inflicting a very fevere wound by the fpines of the firſt dorſal fin, which, if neglected, becomes cancerous, according to *Rondeletius* *. For ſeveral hours, the part affected is attended with a violent burning, and ſhooting pain, ſometimes with an inflamation, that reaches from the arm to the ſhoulder. Theſe effects are commonly ſuppoſed to proceed from ſomething venemous, lodged in the ſpines, which look indeed ſuſpicious; for thoſe of the firſt dorſal fin are dyed with a blackiſh ſubſtance. Various remedies are applied to relieve the pain of this wound. *Rondeletius* recommends the fleſh or brains of the animal; our fiſhermen rub the parts affected with ſea ſand; while thoſe of *Scarborough* ſucceſsfully uſe ſtale urine, applied warm.

This animal is excellent food, and therefore is often taken, notwithſtanding the noxious quality of the ſpines: it buries itſelf in the ſand, leaving only its noſe out; and if trodden on, immediately ſtrikes with great force, each blow directed with a degree of judgment that evinces a conſciouſneſs in the animal of its own noxious powers †. *Willoughby* deſcribes three ſpecies belonging to this genus; the firſt is the fiſh above deſcribed; the ſecond a larger kind, ſeen at *Rome*, with beautiful variegated colours; and the third a *Brazilian* fiſh, called *niqui* by the natives.

* De piſcibus, 300. † Brit. Zool. claſs iv. genus 18.

## Genus XXII. *The Cod* *.

This genus contains a very numerous, and well known tribe of fiſhes, a conſiderable part of which frequent the *Britiſh* coaſts, and contribute more largely to the ſubſiſtence of the inhabitants of *Europe*, than any of thoſe families which we have hitherto reviewed. Their general characters are, a ſmooth head; ſeven ſlender branchioſtegous rays; an oblong body, covered with ſmall deciduous ſcales. The number and ſituation of the fins are various; the teeth are ſmall, and numerous, placed upon each jaw, and in the upper part of the mouth †.

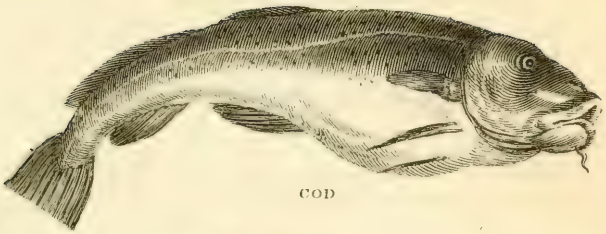
The ſtated migrations of moſt of the fiſh that compoſe this genus, is one of the moſt remarkable circumſtances in their hiſtory: in theſe annual voyages, in the immenſity of their numbers, and in their ſocial habits, they bear a ſtrong analogy to birds of paſſage. The cod, the haddock, and the whiting, iſſue forth in immenſe ſhoals from the artic ſeas, very early in the ſpring, and after having diſperſed over the temperate latitudes, again regularly return to their northern retreats about the ſame time of the year. The neceſſity of procuring food has been aſſigned as the cauſe of their annual migrations from the artic ſeas; and their retreat thither has been aſcribed to the ſecurity that theſe unfrequented tracts are ſuppoſed to afford them, while they depoſite their ſpawn.

But

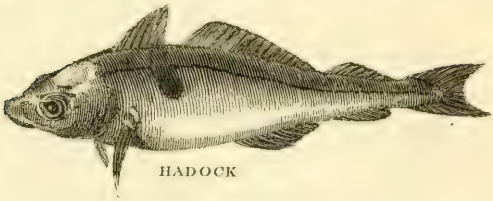
* Aſellus Major Vulgaris, Willough. Gadus Morhua, Lin. Syſt.

† Britiſh Zool. claſs iv. gen. 19.

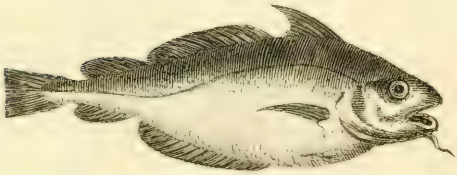
Plate XV.



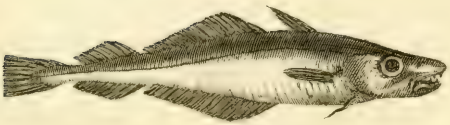
COD



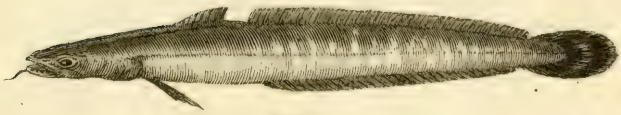
HADOCK



WHITING POUT



WHITING



LING

But although the cod undertakes annual excurſions of conſiderable length, it ſtill may be regarded as a local fiſh; for it never ventures into the warmer tracks of the ocean. None are found in the *Mediterranean* *; and few in thoſe parts of the *Atlantic* of the ſame latitude. They are in greateſt perfection, and ſeem to prefer that ſpace lying between the fiftieth and ſixtieth degrees; ſuch as are caught beyond it, being always inferior, both in quantity and quality †. Their grand reſort for centuries paſt, has been on the banks of *Newfoundland*, and other ſand banks off *Cape Breton*. That extenſive flat ſeems to be the broad top of a ſubaqueous mountain, every where ſurrounded with a deeper ſea. Hither the cod annually repair, in numbers beyond the power of calculation, to feed upon the worms that ſwarm upon the ſandy bottom. Here they are taken in ſuch quantities, that they ſupply all *Europe* with a conſiderable quantity of proviſion. The *Engliſh* have ſtages erected all along the ſhore, for ſalting and drying them; and the fiſhermen, who take them with the hook and line, draw them as faſt as they can throw them out ‡.

This immenſe capture makes no ſenſible diminution of their numbers; for after their food is conſumed in theſe parts, or when the ſeaſon of propagation approaches, they take their departure for the polar ſeas, where they depoſit their roes in full ſecurity, and repair the waſte which has been occaſioned by death, or the depredations of their enemies. They annually make their appearance on the coaſts of *Iceland*, *Norway*, and *Britain*, gradually diminiſhing in their numbers, as they proceed to the



* Rondeletius de piſcibus. † Britiſh Zool. ubi ſupra.

‡ Goldſmith's Nat. Hiſt. vol. vi. page 325.

fouth, and ceaſing altogether before they advance to the ſtraits of *Gibraltar* *.

Before the diſcovery of *Newfoundland*, the greateſt fiſheries of the cod were on the coaſts of *Iceland*, and the weſtern iſles of *Scotland*, where the *Engliſh* reſorted in queſt of them, as early as the beginning of the fifteenth century. Our right of fiſhing in theſe parts, however, was not acknowledged by the government of *Denmark* †, till the reign of *James* I. whoſe marriage with a princeſs of that country, ſecured to his ſubjects that indulgence of which they availed themſelves ſo completely, that they had then a hundred and fifty ſhips employed in the *Iceland* fiſhery.

Even on the banks of *Newfoundland*, the *French*, *Spaniards*, and *Portugueſe*, had originally a far larger portion of the fiſhing, than the *Britiſh*: In 1570, the former nations had upwards of three hundred veſſels employed in that trade, when thoſe of the *Engliſh* did not exceed fifty ‡. Matters, however, have ſince been reverſed; and the *Engliſh* ſhipping on that coaſt has immenſely increaſed; it is now ſuperior to that of any other nation, and the trade is deemed a valuable acceſſion to the wealth of individuals, as well as to the naval power of the empire §.

This immenſe fiſhery is conducted in a tract of the ſea, agitated by a perpetual ſwell, and involved in continual darkneſs, by means of a thick fog, that conſtantly hangs over

* Britiſh Zool. † Rymer's fœd. xvi. 275.

‡ Hackluyt's coll. voy. iii. 132.

§ 15000 Britiſh ſeamen are at preſent employed in this fiſhery. Britiſh Zoology.

over it: The bait uſed is herring, a ſmall fiſh called *capelin*, a ſhell fiſh, and bits of ſea fowl. The natural food of the cod is ſmall fiſh, teſtaceous animals, ſuch as crabs and whelks; and their digeſtive powers are ſo ſtrong, that they diſſolve every ſubſtance which a voracity almoſt indiſcriminate, leads them to devour. Their ſight is probably very imperfect; for almoſt every ſmall body that is agitated by the water, attracts their rapacity, ſtones and pebbles not excepted, for theſe are often found in their ſtomachs.

The ſounds of the cod fiſh, are reckoned a great delicacy, and frequently brought from *Newfoundland*, ſalted up by themſelves: They are employed by the fiſhermen of *Iceland*, in making iſinglaſs; are obtained, by carefully ſeparating them from the back-bone, to which they adhere after the fiſh is cut up *.

The general weight of the cod fiſh on the *Britiſh* coaſts is from fourteen to forty pounds; ſome have indeed been caught near eighty, but thoſe of the middle ſize are moſt eſteemed for the table. Their time of ſpawning is from January to April, when they depoſit their eggs in rough rocky ground. After having been exonerated of a load containing frequently three millions of young, the parent recovers its plumpneſs ſooner than almoſt any other fiſh; and is caught in good condition, during almoſt the whole ſummer.

*Schonfeldt* remarks a kind appointment of providence in the immenſe fecundity of this fiſh, and in that abundant ſupply which it affords to the inhabitants of thoſe bleak

* Phil. Tranſ. 1773. † *Vide* Schon. apud Willough. pape 166.

bleak and frozen countries, that are unfit for the production of grain. The ichthyophagi of theſe barren regions, ſays he, not only furniſh themſelves with a ſubſtitute for bread, by drying this fiſh, but ſend a vaſt quantity of their ſurplus ſtores to add to the ſupply of other nations *. The numbers and fertility of theſe fiſh, ſeem indeed amply to juſtify the grateful exultations of this writer; for they are ſuch as will forever baffle all the efforts of man, and the voracity of the inhabitants of the ocean, to exterminate their race; and will ſecure to every age an inexhauſtible ſupply of wholeſome proviſion.

The cod is a fiſh ſo well known, that it requires not any particular deſcription; the colour, which is commonly ſinereous, and ſpotted with yellow on the back and ſides, varies much according to the age and reſidence of the animal.

## *The Hadock* †.

THIS ſpecies appears upon the coaſts of *Britain* annually, particularly thoſe of *Yorkſhire*, about the middle of December, and in ſuch vaſt ſhoals, that they cover a tract frequently of many miles. They do not venture far from the ſhore; when the fiſhermen caſt their lines beyond their limits, which is commonly about three miles from

* *Vide* Schonf. apud Willough. page 166.

† Gadus Æglefinus. Lin. Syſt. Tertia aſellorum ſpecies.

from land, they are ſeldom any taken. The larger hadocks leave the coaſt as ſoon as they begin to be out of ſeaſon, leaving behind only the ſmaller fiſh This remark is applicable to all the fiſh that appear on the *Yorkſhire* coaſt, except the mackrel, which alone remains after becoming unfit for uſe *.

The hadock is the moſt common ſpecies in the *London* market, as it is not only plenty, but in ſeaſon during the greateſt part of the year. The larger fiſh begin to roe in the middle of November, and continue ſo till the end of January, when they are unfit for uſe. Thoſe of the middle ſize recover about the beginning of May, and are in ſeaſon till February ; ſuch as are incapable of breeding remain at all times fit for the table. In ſtormy weather none of this ſpecies take the bait; the fiſhermen aſſert, that they then ooze in the bottom of the ſea, and ſhelter themſelves there, till the agitation of the water has ceaſed: In proof of this, they allege that thoſe which are taken immediately after a ſtorm, are covered with mud upon the back.

The common ſize of the haddock is twelve inches in length, of a dark colour upon the back, and the ſkin covered with ſmall ſcales. On each ſide about the middle is a large black ſpot, the prints, as it is ſaid, of the finger and thumb of *St. Peter*, when he held this ſpecies, and took the tribute out of its mouth: A mark which ſuperſtition has extended to the whole race of hadocks, at once to atteſt and commemorate that miracle; unfortunately, however, the haddock is not the only fiſh that has been ſuppoſed to be thus diſtinguiſhed by the marks of the apoſtolic touch †.

Of

* Britiſh Zoology. † Willough. page 170.

Of the ſame genus, but inferior in ſize, are the pouts, blinds, and poors. The latter is the ſmalleſt of the cod kind yet diſcovered; and it is the only one found in the *Mediterranean*. It is taken near *Marſeilles*, and in ſuch quantities as ſometimes to prove a nuiſance. It ſeldom exceeds ſix inches in length, and is unfit either for being dried or ſalted; if the firſt is attempted, it grows as hard as an horn *. The whiting is the moſt delicate and wholeſome food of any of this genus: It appears in vaſt ſhoals on our coaſts in ſpring, and is caught with the line, from one to three miles from the land.

## *The Coal-Fiſh* †.

All the ſpecies of the cod, which we have mentioned, are diſtinguiſhed by a barb under the lower jaw; in the coal fiſh this is wanting. It is of a dark cerulean blue, and has from that circumſtance obtained its *Engliſh* name. The eyes are large and protuberant, and the upper jaw, which in the common cod projects beyond the lower, in this ſpecies is the ſhorteſt of the two ‡.

The coal fiſh frequent the rocky and deep coaſts all round this iſland, but are found in greateſt plenty in the vicinity of the *Orkneys*, where their fry conſtitute a great

* Belon de piſcibus, p. 120.

† Colfiſch Anglorum, Geſn. Gadus Carbonarius, Lin. Syſt.

‡ Will. p. 168.

great part of the ſupport of the poor. The young begin to appear on the coaſt of *Yorkſhire*, in the month of July, in numbers that defy all computation: They are at that period only an inch and a half long; in Auguſt they are from three to five inches, and are taken in vaſt quantities with the angling rod; they are then reckoned a very delicate diſh, but afterwards grow ſo coarſe, that, by the time they are a year old, few people eat them*. They are ſold either freſh, or when ſalted, in the counties of *York* and *Northumberland*, at an inferior price to the other ſpecies of cod.

## *The Hake* †.

This ſpecies has only two dorſal fins; grows from two to three feet in length, and is of a more ſlender ſhape than the common cod. Its form ſomewhat reſembles that of the pike; whence it is called the ſea pike by the *French* and *Italians* ‡. The mouth is large, and furniſhed with a mixture of ſhort and long teeth; and the palate, as is common to the fiſhes of this genus, is beſet with ſharp ſpines or teeth. The firſt dorſal fin has nine rays; the ſecond, which extends almoſt to the tail, has forty; the pectoral fins are furniſhed each with twelve rays; and the ventral, which are ſituated before, are ſupported by ſeven cartila-



* Vide Schon. apud Will. p. 169.

† Aſellus primus. Will. Gadus Merlucius, Lin. Syſt.

‡ Merlucius, Vide Geſner and Will.

ges; the tail is not forked, but each ray being equally produced, terminates in the ſame ſtraight line.

The hake is found in abundance on many of our coaſts; particularly thoſe of *Ireland*, where there was formerly a ſtated fiſhery on the *Nymph Bank* off *Waterford*; immenſe quantities were caught there at the two ſeaſons of their periodical appearance, June and September, when ſix men with hooks and lines frequently killed a thouſand fiſh in one night; the produce of this fiſhery was ſalted up and exported to *Bilboa* in *Spain*; it has, however, been for many years upon the decline, owing to the fiſh deſerting their wonted ſtation *.

This dereliction of their accuſtomed haunts, is not peculiar to the fiſhes of this ſpecies; the haddock has in the ſame manner abandoned the coaſts of *Waterford*, and the herrings and the baſking ſharks have diſplayed the ſame caprice, in relinquiſhing their ſtations on ſeveral parts of the *Britiſh* ſhores. Naturaliſts have not yet given any plauſible account of this irregularity in the migration of fiſhes: In ſome inſtances it may be occaſioned by the cloſe purſuit of an unuſual number of predatory fiſh, to avoid whoſe voracity they may be driven upon ſhores that they were formerly unaccuſtomed to frequent; a deficiency of the ſmaller fiſh, that ſupplied them, may, in other inſtances, have forced them to abandon a reſidence, where they could no longer be ſupported. But the pernicious cuſtom of trawling, is perhaps the moſt common cauſe of their abandoning the uſual ſtations, becauſe, by that means, not only a great part of their ſpawn is demoliſhed, which was lodged in the ſand, but the worms and infects

* Smith's Hiſt. of Waterford, p. 261.

infects which conſtituted their food, are either deſtroyed by it, or driven into deeper water *.

There are three varieties of the hake found in our ſeas, beſides that above deſcribed; the greater and leſſer forked hake, and the three forked ſpecies: The laſt, *Linnæus* has omitted in the Syſtem of Nature; and the two former he has placed among the blennies. The bifurcated hake is about twelve inches in length; the colour a deep brown, excepting the colour of the lips, which are ſnow white; theſe ſurrounding a broad flat ſnout, give the animal a ſtrange appearance, ſufficiently characteriſtic of the ſpecies.

## *The Ling* †.

THIS ſpecies is longer than the river pike, being from four to ſix feet; the ſides and back in ſome are olive-coloured, in others cinereous; and the whole figure of the body nearly reſembles that of the fiſh laſt deſcribed: the upper jaw projects beyond the lower, both being exaſperated with ſeveral rows of ſhort teeth; the palate is armed in the ſame manner, with parallel rows of ſmall teeth, here and there interſperſed with a few of ſuperior ſize, ſtrength, and ſharpneſs; the mouth and tongue are large; from the corner of the lower jaw there hangs a ſingle



* Brit. Zool. Claſs iv. gen. 19.

† Aſellus longus, Will. Gadus molva, Lin. Syſt.

barb about two inches long; upon the back are two dorſal fins, the firſt conſiſting of fifteen, and the ſecond of ſixty-five rays, extending like the anal fin, oppoſite nearly to the tail; the pectoral fins are each ſupported by fifteen cartilaginous rays, and the ventral by ſix; the three firſt projecting beyond the connecting membrane, terminate like ſpines *.

The ling abounds more or leſs upon the coaſts all round the *Britiſh* iſles; it is, however, moſt frequent near *Scilly* iſles, and thoſe on the weſt of *Scotland* and *Ireland*, where it has long formed a conſiderable branch of commerce, regulations being framed concerning it ſo early as the reign of *Edward* III †. The fiſh is in perfection from the beginning of February till May; in June they depoſit their ſpawn in the ſoft, muddy bottoms near the mouths of rivers; about this time the males ſeparate from the females, many of the former being caught by fiſhermen, without a ſingle individual of the latter.

When the ling is in ſeaſon, its liver is white, and abounds with an oil of an excellent quality and flavour; but as ſoon as the fiſh becomes out of ſeaſon, the liver gradually aſſumes a red colour, reſembling that of an ox, and it then produces no oil: The ſame change of colour of the liver is obſerveable in cod, and ſeveral other fiſhes, but not in a degree ſo remarkable. It would ſeem, that this oil which is lodged in the cellular membranes of fiſhes, returns into their blood, and ſupports them during the period of procreation; a ſeaſon in which they purſue the work of generation with ſo much eagerneſs, that they neglect their food.

As

* Will p. 175. † Brit. Zool. Claſs iv. gen. 19.

As the oil of this ſpecies can only be obtained while the animal is in ſeaſon, ſo it can be extracted from the liver only by a ſlow fire; if a violent heat be applied in melting it, a very ſmall quantity will be had from the fiſh, even in its greateſt perfection. Such fiſh as are cured for exportation, muſt meaſure a certain length from the ſhoulder to the tail, otherwiſe they are not entitled to the bounty which parliament has granted for the encouragement of this trade; twenty-ſix inches is the length of a ſizeable fiſh; thoſe of inferior dimenſions are called drizzles, and becauſe incapable of procreation, they continue in ſeaſon during the whole ſummer *.

There is a freſh water fiſh that ſomewhat reſembles the ling, called the burbot, or eel-pout †: it abounds in the lake of *Geneva*, where it is called lota, and is found alſo in ſeveral of the rivers in the north of *England*. The body is ſmooth, ſoft, and lubricated like that of the eel; the number and diſpoſition of fins, reſembles that of the ling: The ſeaſon of generation in this ſpecies is December; at which period, though the body is ſmall, one hundred and twenty-eight thouſand ova have been taken from a ſingle female, each of which is capable of becoming a fiſh, after fecundation by the male.

* Brit. Zool. ubi ſupra. † Will. p. 125.

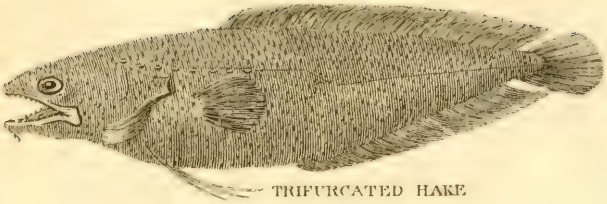
## *The Five-Bearded Cod* *.

THE colour of this is a deep olive brown; in its ſhape and ſlimy covering it ſomewhat reſembles the eel; it is, however, much ſhorter and thicker, eſpecially towards the belly: There are two different ſpecies, the one with five beards, and the other uniformly with three; the former has four upon the upper jaw the latter only two. From the extremity of the lower jaw in both, there hangs a beard: The ſcales of both kinds are extremely minute; each has the ſame number of fins, and in the ſame poſition; they are diſtinguiſhed by the ſhape of the two dorſal fins; the firſt riſes a little way behind the head, where it is lodged in a deep furrow, and conſiſts of a number of ſhort unconnected rays, or filaments; behind this furrow, in the middle of the back, riſes the ſecond dorſal fin, conſiderably higher than the firſt, and extending almoſt to the tail, which is rounded at the extremity; this fin is ſupported by fifty-ſix rays, and the anal one, oppoſite to it, by forty-ſeven. This ſpecies grows to the length of nineteen inches, and weighs upwards of two pounds.

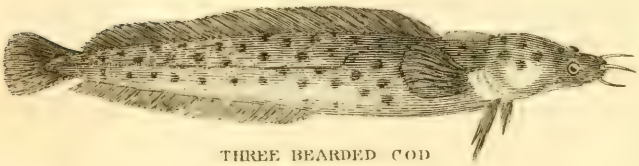
The three-bearded cod is nearly of the ſame ſize with the other, of which *Willoughby* reckons it only a variety; it is, however, eaſily diſtinguiſhable, by having the upper part of the body variegated by a number of black ſpots upon a reddiſh ground. The *Corniſh* fiſhermen have

* Muſtela vulgaris, Rond. Sea-Loach, Will.

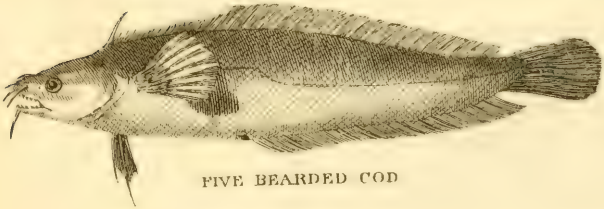
Plate XVII



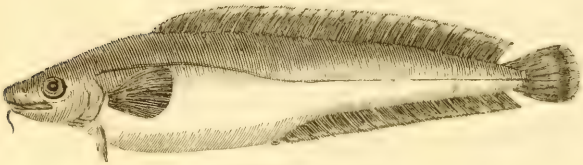
TRIFURCATED HAKE



THREE BEARDED COD



FIVE BEARDED COD



TORSK

have particular cant phraſes, by which they imagine they charm theſe fiſhes, which they repeat in the ſame manner that the *Sicilians* do their *mamaſſu di pajanu*, &c. when they are in purſuit of the ſword-fiſh *.

## *The Torſk.*

We have already ſeen the fiſhes of this genus, poſſeſſing, ſome three, others two dorſal fins; the fiſh now under obſervation is an inhabitant of the *Orkney* ſeas; and from having only one dorſal fin, forms a claſs diſtinct from both. It is called by the inhabitants of *Orkney* and *Shetland*, tuſk or briſmac; and is ſeldom found in a lower latitude than that of theſe iſlands, where it ſwarms in great abundance, and is either dried or barrelled up for exportation.

The torſk grows commonly to the length of twenty inches, and to the depth of four; the head is ſmall, the upper jaw projecting beyond the lower, and both armed with a multitude of ſmall teeth. The fiſh known in *Sweden* by the ſame name, is deſcribed by *Linnæus* with three dorſal fins; that of the *Orkneys*, however, has only one riſing about ſix inches behind the ſnout, and extending nearly to the tail; oppoſite to it is the anal fin, commencing at the anus, and reaching the ſame length; the rays

* Brit. Zool.

rays of each are but indiſtinctly perceived, on account of the thickneſs of the membrane that covers them.

From the extremity of the lower jaw there hangs a ſingle beard; the colour of the head is duſky, that of the ſides and back is yellow, and of the belly white; the pectoral fins are brown; the dorſal, caudal, and anal fins, are duſky, ſurrounded by a white margin.

## Section V.

### Genus XXV.—*The Blenny.*

The generic characters of this tribe, are, a ſhort, blunt ſnout, a ſmooth body, covered with a glutinous ſubſtance, and compreſſed laterally. The teeth are ſlender, and the ventral fins ſmall, ſupported only by two connected rays. The dorſal fin begins a little behind the head, and reaches the whole length of the back. The fiſhes of this genus are variouſly claſſed by naturaliſts, ſome of them being mingled with thoſe of the laſt, while others are claſſed with the ſea ſcorpions, and other heterogeneous tribes. *Linnæus* enumerates thirteen different ſpecies of the blenny, only four or five of which are known to frequent our coaſts; the gattorugine, the creſted, the ſmooth-headed, the ſpotted, and viviparous blenny; all theſe haunt the rocky ſhores, and at low water are found under the ſtones among the tang. They are extremely active and vivacious; by means of their ventral fins they can creep among the rocks; and ſome ſpecies can live out of the water during the length of a whole day.

## *The Gattorugine* *.

The ſpecies has been found on the coaſt of *Wales;* the body is without ſcales, and lubricated with a ſlimy ſubſtance. Towards the head it is thick, gradually diminiſhing towards the tail; the ſides all along conſiderably compreſſed. It is above of a duſky hue, marked acroſs with undulating lines; below of a pale aſh colour, the ventral and pectoral fins partly orange. The rays of all the fins of this ſpecies project beyond their webs, and have a ſpiny appearancee. The eyes are ſituated almoſt upon the ſummit of the head, contiguous, and extremely protuberant; between them ariſes a kind of creſt, which ſeparates into four branches, and which can be raiſed or depreſſed by the animal at pleaſure. The *cirri* forming this creſt are thick at the baſe, ſharpening towards the top, and ſetaceous along the ſides †.

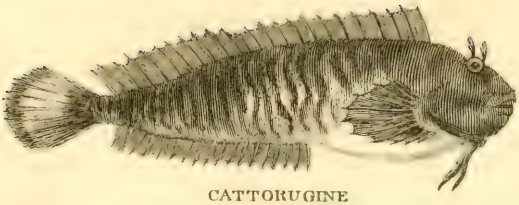
Similar to the gattorugine, is the creſted blenny, a fiſh diſtinguiſhed by the ſame creſt-like fin upon the top of the head. Its reſidence is the ſame; for it is always found on the rocky ſhores, where it probably feeds on crabs and ſmall ſhell-fiſh; the remains of thoſe animals being found in its ſtomach ‡.

The ſmooth blenny reſembles the creſted, almoſt in every reſpect, except that of the ſmoothneſs of its forehead, which is deſtitute of that erect fin, the uſe of which no naturaliſt has hitherto pointed out.

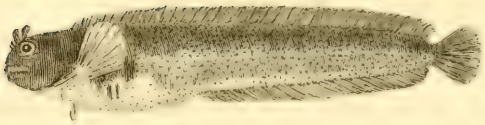
* Gattorugine Vinetiis, Will. Blennius Gattorugine, Lin. Syſt.

† Vid. Willough. p. 132. ‡ Brit. Zool.

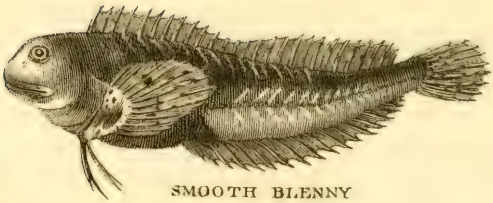
Plate XVIII.



CATTORUGINE



CRESTED BLENNY



SMOOTH BLENNY

VIVIPAROUS BLENNY

## *The Viviparous Blenny* *.

THE viviparous blenny in its mode of generation, differs from the whole order of ſpinous fiſhes, in producing living young. In conſequence of this, its habits muſt be conſiderably different. Impregnation muſt take place within the body of the female, who, like moſt other viviparous animals, probably is diſtinguiſhed by parental affection for her brood, which generally conſiſts of two or three hundred. The ſeaſon of her parturition is a little after the depth of winter; before impregnation by the male, the eggs are ſmall, and of a whitiſh colour; after that period they are gradually increaſed in ſize, and aſſume a red appearance. By and by they acquire an oblong ſhape, and two black ſpots begin to announce the rudiments of the head and eyes; after this the belly and viſcera begin to appear: they are covered with a milky pellucid membrane, through which the inteſtines are ſeen: Laſt of all, the tail becomes diſcernible, like a ſmall thread, bending towards the extremity.

During the whole time of geſtation, the abdomen of the female is greatly diſtended, not only by the young brood, but alſo by a white muddy ſubſtance, which probably ſupplies the naſcent family with food. As the period of parturition approaches, this liquid gradually diminiſhes in quantity, till, upon the young attaining their full ſize,



* Muſtela marina vivipara, Schon. Blennius viviparus, Lin. 978.

it almoſt wholly diſappears, as if conſumed by the numerous race which it has ſupported *.

When the fœtus have acquired nearly their complete ſize, they creep from place to place in the uterus, as if attempting to diſengage themſelves from a ſtate of confinement, which is now no longer neceſſary: after parturition, they are immediately capable of ſwimming and following the mother; and of ſupporting life by the ſame movements of the mouth and gills.

The young of the viviparous blenny, at their firſt appearance, are about two inches long; when full ſized, they are nearly a foot. Their fleſh is extremely coarſe, and unſavory; it is ate chiefly by the poor, who ſometimes take them in their pregnant ſtate; and leaſt their numerous young when dreſſed, ſhould adhere to their knife or fingers, they take the female, before boiling, and ſtrip her of her young, by paſſing the hand along the belly. Several of theſe fiſh are caught in the river *Eſk*, in *Yorkſhire*, by throwing lines from the top of the bridge †.

* Willough. p. 123.

† Britiſh Zoology, claſs 4. genus 20.

## Division III.—*Thoracic Fishes.*

### Section VI.

### Genus XXVI.—*Cepola* *.

We are now come to that division of the spinous tribes termed by naturalists the thoracic, from the position of their ventral fins, which are neither placed before the pectoral, nor behind them, but directly under them upon the thorax †. The first genus of this class, Linnæus terms the cepola, in the latter editions of his System of Nature, from a fish of that name caught in the *Mediterranean*. This animal has an extremely slender and tapering shape; the body being twelve inches in length, and scarcely one in thickness: It is of a flesh colour, and semitransparent, so that the vertebræ of the back appear, and can easily be numbered.

The cepola has no scales: the sides are adorned with a lineal row of silvery spots. The pectoral fins are small, and their rays so slender, that they are almost imperceptible. About an inch behind the head, rises the dorsal fin, which is produced till it joins the tail, where it meets the anal fin, which is about thrice as broad; and begins so

* Tœnia prima, Rond. Cepola tœnia, Lin. Syst.

† Vide Systema Nat. 156.

ſo near the throat, that the anus is ſituated almoſt immediately below the angle of the lower jaw. This fiſh is ſold in the markets of *Rome*; but its fleſh, according to *Rondeletius*, is of a very indifferent quality *.

The only remaining fiſh of this genus is the red cepola, called by the *Genoeſe* cavagiro †. The body of this ſpecies is more ſlender and compreſſed than that of the eel: The ſides, back, and tail, are of a pale red; the belly white, and the whole body is deſtitute of ſcales. The dorſal fin begins immediately behind the head, extending along the back till it meets the anal fin oppoſite to it, at the extremity of the tail. In the larger fiſhes, theſe fins diſplay a great brilliancy of colour; at the baſe they are of a beautiful yellow, and at the top a fine purple. The ventral and pectoral fins are placed exactly oppoſite to each other, upon the thorax.

* De piſcibus. † *Vide* Will. p. 117.

## Genus XXVII.—*Remora* *.

The remora, or ſucking fiſh of the *Engliſh*, is about eighteen inches in length, almoſt round. The ſkin is deſtitute of ſcales, ſmooth, and hard like leather. The head is oval, flattened, and broader than the body: The jaws are of unequal length, the lower projecting beyond the upper; both however are armed with ſmall ſharp immoveable teeth, covered by the lips †. The two ventral fins are united by a membrane; the pectoral are of a triangular ſhape, and two inches and an half in length.

The hind part of the head diſtinguiſhes the remora from every other fiſh; it extends apparently two inches upon the back; it is quite flat, and ſtriated with tranſverſe lines, like the palate of other fiſh. It is with this part that the animal adheres to the belly of the white ſhark ſo cloſely, that the latter when taken is found ſticking faſt to its ſkin ‡.

* Remora, Rondel. Echineis Remora, Lin. Syſt.

† *Vide* Guan. Hiſt. piſcium, p. 184.

‡ De Terrey apud Willoughbium, p, 119.

## Genus XXVIII.—*Chorythæna.*

This genus comprehends twelve ſpecies that are all exotics: their characters are a large bony head, flat, and ſloping towards the ſnout, which appears ſhort and mutilated, as if cut through. The jaws are obtuſe, of an equal length, and furniſhed with teeth; the palate is alſo frequently exaſperated with ſmall ſpine-like teeth. The back is convex and carinated, and the whole body of a uniform ſhape.

### *The Pompilus* *.

This fiſh is ſaid by *Pliny*, to accompany veſſels for ſeveral hours when ſailing on their voyage, and will not leave them even though threatened with deſtruction by the ſailors †. It is an inhabitant of the open ſea, and is eaſily diſtinguiſhed by a broad curved line, proceeding from the gills to the tail. Above this line the body is variegated with a number of ſpots; below it, towards the belly, the ſides are marked with tranſverſe doted lines ‡. Above the eyes is a large ſpot of a gold colour. The fins

* Pompilus Rond. Idem. Plinii.
† Hiſtoria Animal.
‡ *Vide* Rond. apud Will. p. 214.

fins are four, two pectoral and two ventral, beſides a large dorſal and an anal fin, each extending to the tail. From its remote habitation in the ocean, this fiſh is but rarely caught; and even in the *Italian* markets, where it is ſometimes ſold, it has no appropriated name.

Another remarkable fiſh of this genus is the hippurus, alſo an inhabitant of the ocean, and never found upon our coaſts. *Rondeletius* had an opportunity of examining this animal in *Spain*, where it is called *lampugo*, and appeared to him to be diſtinguiſhed from the whole finny tribe by its ſuperior beauty *. Immediately above the roſtrum, there ariſes a large creſt-like fin, which continues uninterrupted to the tail, where it meets with a ſimilar fin upon the belly. The pectoral fins are rounded and broad, reſembling ears; the ventral extend the half length of the body. The mouth is moderately large, armed in the jaws, palate, and tongue, with ſmall ſharp teeth. The eyes are large; the body covered with ſmall ſcales, and of a pale blue colour.

The ancient naturaliſts believed, that this animal lay hid in a dormant ſtate during winter, like the ſerpent; and that its young increaſed in ſize in a far more rapid manner than thoſe of any other fiſh. The *Spaniſh* fiſhermen, after taking the young, ſhut them up in pools, where they pretend that a difference of their ſize is perceivable every day †. The other fiſhes of this genus are moſtly peculiar to *South America*, and are only known by the barbarous names affixed to them by the natives.

* De piſcibus. † Ariſtotle Hiſt. Animal. lib. 5. cap. 10.

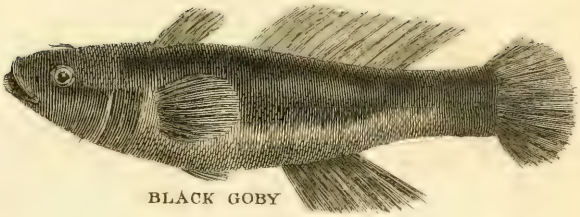
## Genus XXIX. *The Goby.*

THERE are eight ſpecies belonging to this family, that are enumerated by the *Swediſh* naturaliſt. Their common characters are, the body ſtraight, and gently compreſſed; the ſkin rough, with a thick coat of ſmall imbricated and deciduous ſcales. The jaws of equal length, armed with ſmall, ſharp and immoveable teeth. The dorſal fins are two; the firſt ſmall, conſiſting only of a few rays, the ſecond broad and high; the pectoral fins are large, and rounded at the ends; while the ventral are united, and have the appearance of a funnel.

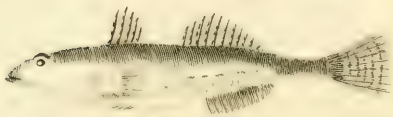
There are only two ſpecies of the goby known to frequent our coaſts, the black and the ſpotted. The firſt grows to the ſize of ſix inches; the ſecond only three, and is frequently caught in the ſhrimp nets upon our ſandy ſhores *. Two or three other ſpecies frequent the *Mediterranean*; but as they are of no value, their habits and manners are but little known.

* Britiſh Zoology.

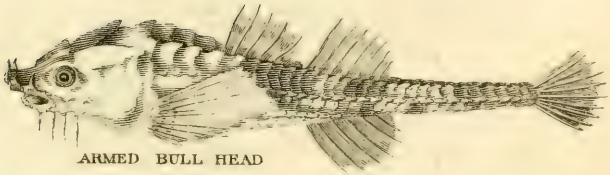
Plate XIX.



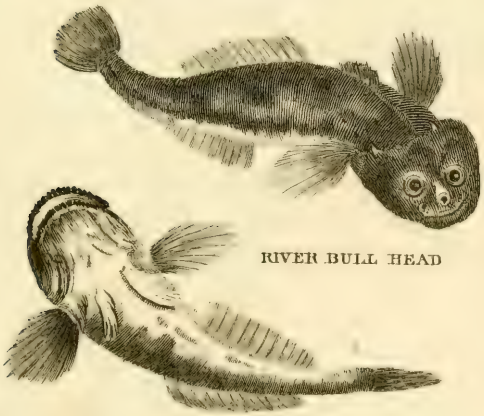
BLACK GOBY



SPOTTED GOBY



ARMED BULL HEAD



RIVER BULL HEAD

## GENUS XXX. *The Bull-head.*

THIS deformed tribe is diſtinguiſhed by a large diſproportioned head, much broader and thicker than the body; the viſage is rendered ſtaring and hideous, by two large eyes placed above; and the whole of this unſhapely head is armed with ſpines. Some of this genus are inhabitants of the freſh water, while others are peculiar to the ſea. There are ſix ſpecies enumerated by ichthyologiſts.

### *The River Goby* *.

THIS ſmall ſpecies ſeldom exceeds three inches and a half, and is very generally found in all our clear ſtreams, lying at the bottom, either under a ſtone, or upon the gravel. It depoſits its ſpawn in the ſand, in a receptacle dug for the purpoſe; and its concern for its future progeny is ſuch, that with reluctance it leaves the ſpot from which it is to riſe. The freſh water inſects are its food; the pulex aquatilis being frequently found in its ſtomach †.

The

* Cottus Gobio, Lin. Syſt. Bull-head, Miller's Thumb. Willough.

† Britiſh Zoology.

The back is of a yellow colour, variegated with three or four tranſverſe patches of black. The mouth as well as the head, is diſproportionably large: The pectoral fins are broad and rounded; the ventral extremely ſmall, having only four rays *. The anal, and two dorſal, are larger than uſual in fiſhes of the ſame ſize. There is a ſpecies found in the lakes upon the continent, of ſtill an inferior magnitude to our river bull-head, and of a brighter colour.

The armed bull-head, or pogge, as it is called in the north of *England*, is an inhabitant of the ſea, much larger than the ſpecies noticed, and formidable, as well as hideous in its appearance. It is near a foot in length; the head triangular, and armed with a number of ſharp tubercles upon each ſide; the ſnout is flat, and turned up, armed alſo on the point with four ſtrong curvated pikes; below the chin are a number of *cirri*, forming a copious beard, which adds to the threatening aſpect of this animal. The body, from the head, a conſiderable way down, is of an octagonal ſhape; near the tail it becomes hexagonal, and is entirely covered with large bony ſcales, which give the body its angular form †.

* Willough. page 137. † Willough. page 217.

## *Father Laſher* *.

This ſingular animal is about half a foot in length, and in ſhape reſembling the goby; the head and anterior parts being diſproportionably large, the poſterior ſlender as they approach the tail. It has no ſcales; but the ſides are divided each by a rough lateral line. The head is blackiſh; the back variegated with pale and black patches, placed tranſverſely: Below the lateral lines, the ſides are yellow, and whiten as they approach the belly. The coverts of the gills and the crown of the head are beſet with formidable ſpines, by the ſtroke of which this ſmall fiſh can inflict a painful wound †.

The whole aſpect of this fiſh is threatening; and as it knows the uſe of its defenſive weapons, it can increaſe the terror of its enemies, by ſwelling the opercula of the gills and the cheeks to an enormous ſize. It ſeems to have been long well known in the *Mediterranean*, though not for its peaceable and innoxious habits; for it is thus characteriſed by the poet:

Et capitis duro nociturus ſcorpius ictu.

The ſcorpion threatening wounds with its bony head.

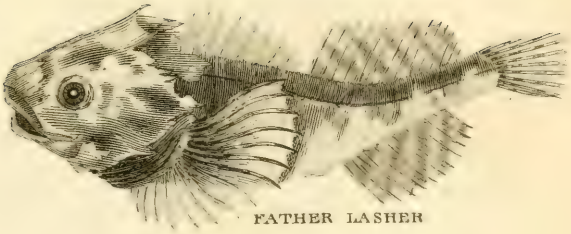
The

* Cottus Scorpius, Lin. Syſt. Father Laſher, Will.

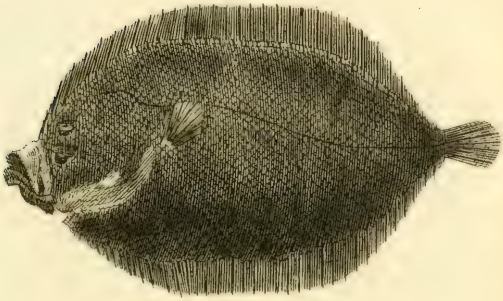
† Willough. p. 138.

The *American* ſpecies is exactly ſimilar to our own, and is frequent in the *Newfoundland* ſeas, where it is called ſculping. It abounds alſo on the coaſt of *Greenland*, where it is caught in deep water off theſe bold ſhores, and conſtitutes a very palatable diſh to the natives ‡.

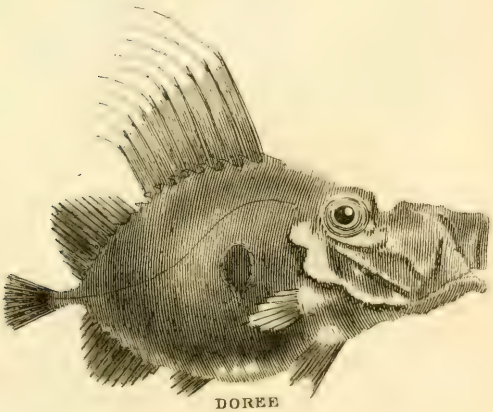
‡ Brit. Zool. Claſs iv. Gen. 22.



FATHER LASHER



SMEAR DAB



DOREE

## Section VII.

### Genus XXXI.—*The Doree* *.

This ſpecies is in all parts of an equal thickneſs; the body is extremely deep, and ſtrongly compreſſed laterally; ſo that in ſhape it reſembles the flounder; but ſwims erect, and not on the ſide. The head is flat laterally; the mouth immoderately large, being, together with the head, bigger than the body. The eyes correſpond in ſize with the head; the pupil large and protuberant, and the irides yellow. It is ſufficiently diſtinguiſhed from every other fiſh, by the round black ſpot on each ſide, of about the ſize of a ſixpence; a circumſtance from which ſuperſtition has made the doree a rival to the haddock, for the honour of St. *Peter's* touch, when he took the tribute-money from its mouth, by leaving on its ſides thoſe inconteſtible proofs of the identity of the fiſh, the marks of that Apoſtle's finger and thumb †.

But if we are to believe the annals of ignorance and credulity, the doree may claim a ſtill more ancient origin of the ſpots upon its ſides; for we have read that the gigantic St. *Chriſtopher*, in wading through an arm of the ſea, over which he carried our Saviour while a child, caught

* Zeus Faber, Lin. Syſt. Gallus marinus, Rondel.

† Britiſh Zoology.

caught a fiſh of this kind *en paſſant*; and as an eternal memorial of the fact, left the impreſſions on its ſides, to be tranſmitted for the inſpection of all poſterity *.

The hideous aſpect of this fiſh long baniſhed it from our table, till the celebrated comedian and epicure *Quin* introduced it. It required only his aſſertion to make it a delicious fiſh, and effectually to eſtabliſh its reputation among the moſt delicate viands of the times. It is very common in the *Mediterranean*, the *Bay of Biſcay*, and on the *French* coaſt; ſo when *Ovid* terms it *rare* †, it muſt have been owing to its delicacy, rather that its ſcarcity.

There is a ſpecies belonging to this tribe peculiar to the *Indian* ſeas, termed by *Willoughby*, *faber Indicus*, of a very remarkable appearance; the firſt ray of the dorſal fin extends far beyond the tip of the tail; that of the anal fin is nearly of the ſame length; while the two pectoral fins ſeem to conſiſt only of a ſingle ray, and extend almoſt to the tail ‡.

## *The Opah* ||.

THIS fiſh belongs to the genus of dorees, although it far ſurpaſſes them in magnitude, weighing in ſome inſtances an hundred and forty pounds; meaſuring three or four feet in length, by two and a quarter in depth. It is ſo much compreſſed laterally, that its greateſt thickneſs is only four inches. The colour of the opah is a vivid tranſ-

* Willough. page 295, where Aldrov. aſſerts, that it is frequently hung up in the Italian churches, ſo renowned for fable.

† *Rarus Faber.* Vide Halieut. ‡ Willough. Append. 5.

|| Opah, or King-fiſh, Phil. Tranſ. Opah, Brit. Zool.

tranſparent varniſh of ſcarlet, burniſhed over with gold, and beſpangled with oblong ſilver ſpots of different ſizes. The breaſt conſiſted of a hard bone, reſembling in ſhape the keel of a ſhip; and the fleſh had the taſte and appearance of beef *.

The opah has only been four or five times caught on the *Britiſh* ſhores; and as no mention is made of it by *Linnæus* or *Willoughby*, is probably every where a rare fiſh. The fins, as well as the body, are of fine ſcarlet; and from the high encomiums laviſhed by thoſe who have ſeen it, on its brilliant colours, we are led to ſuppoſe that it is one of the moſt beautiful of the tenants of the deep, and to regret its ſcarcity †.

* Brit. Zoology. † Vide Sibbald. Hiſt. Scot. Tab. 6.

## GENUS XXXII.—*The Scorpion* *.

THE animals of this tribe are found in our ſeas; but owing to the paucity of their numbers, they have no appropriated name in the *Engliſh* language. The ſpecies enumerated by *Linnæus* are three. The leſſer ſcorpion reſembles a perch in its external figure; it is thick in proportion to its length, and loaded with an enormous head, rendered frightful by the ſtrong ſpines with which it is beſet.

The colour is a darkiſh dirty yellow, interſperſed with brown ſpots. The ſkin is covered with extremely minute ſcales, reſembling thoſe of ſerpents. Above each eye is a ſmall fin-like creſt, as was obſerved in the blenny; and at the apertures of the noſtrils there is a ſecond pair. Along the back there is one large fin, which, from its lowneſs in the middle, has the appearance of two. The rays upon the firſt lobe are ſharp and prickly, thoſe upon the ſecond are cartilaginous. The pectoral fins are broad, rounded, and prickly; each ray projecting beyond the membranes, and preſenting a large ſpine. The ventral fins, which are exactly oppoſite to them, have alſo a ſpine terminating the firſt ray †.

The large ſcorpion is about five times the ſize of the above; the colour of a deep red, interſperſed with dark ſpots; it is bearded below the under jaw, and has the opercula



* Scorpæna. Lin. Syſt. Scorpæna Salviani. † Willough. p. 331.

opercula of the gills armed at all points with ſtrong ſpines. Theſe weapons are of themſelves ſufficiently formidable to thoſe employed in the capture of this fiſh; but they have been rendered ſtill more frightful by a belief that they are ſupplied with venomous matter. *Rondeletius* mentions a boy who was miſerably hurt by attempting to place one in his boſom: he is fully perſuaded that the wound was poiſonous, and for that reaſon mentions a preſcription delivered by the ancients as its cure. He applied the liver of the fiſh, with an addition of a bruiſed lentiſcus, to the wound, and thereby prevented thoſe dreadful effects which were imagined to be the unavoidable conſequences of a ſtroke from this animal ||.

|| Rondel. de piſcib. art. Scorpius.

## Genus XXXIII.—*The Flounder.*

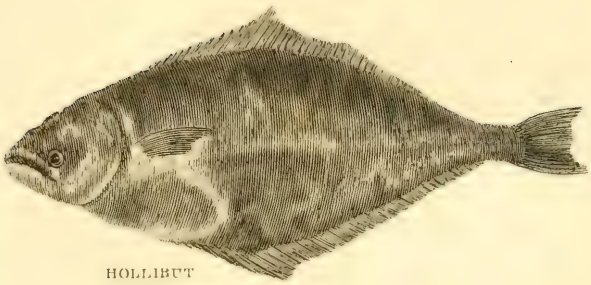
This genus comprehends the numerous race of flat fiſh, which keep conſtantly on one ſide, and reſide at the bottom of the water, from wanting the ſwimming bladder. They make progreſs with one ſide forward, and are, on that account, termed *pleuronectes* by the author of the Syſtem of Nature, who has enumerated ſeven different ſpecies belonging to this tribe. The generic characters of the flounder are ſtrongly marked: The body is flat, and one ſide conſtantly of a different colour from the other. The head, as well as the reſt of the body, is covered with ſmall imbricated ſcales, and both eyes are placed upon the ſame ſide of it *.

The fiſhes of this genus are many of them excellent food, and found in great plenty in our ſeas. From their extreme voracity, they are not difficult to take with the hook and line. Sometimes they have been known to ſwallow the plummet at the end of the ſounding line, while the ſailors were taking the depth of the water †.

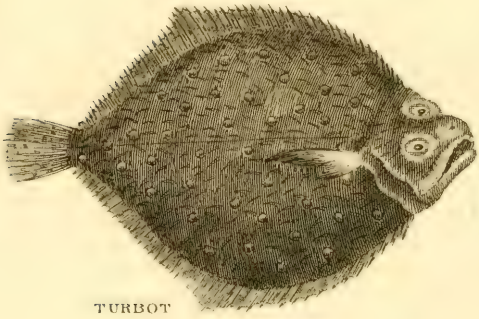
* Gouan. Hiſt. Piſcium, p. 181.

† Britiſh Zool. Claſs iv. Gen. 34.

Plate XXI

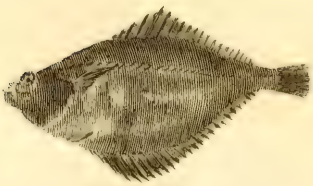


HOLLIBUT



TURBOT

PLAISE



FLOUNDER

## *The Holibut* *.

THIS ſpecies is called in *Scotland* the turbot, though different from the fiſh known in *England* by that name. It is the largeſt fiſh of the flounder kind, and is ſometimes found on our ſhores three hundred pounds weight, while thoſe in the ſeas of *Iceland* and *Newfoundland* greatly exceed even that ſize. In *Greenland* they are alſo caught of a prodigious bulk, with the hook and line, off theſe bold ſhores: There they are cut up into large ſlips, and dried for food to the inhabitants. The holibut is alſo common in the *London* market; but where there is ſuch an abundant variety to chooſe, they are deemed a coarſe unſavoury fiſh, excepting the part which adheres to the ſide fins, which is fat and luſcious.

The colour above is an obſcure green, bordering upon black; that of the belly a pure white. The ſcales are ſmall, and the body all over free from ſpines; even the edges of the fins have no aſperity from the projection of the rays. The eyes are upon the left ſide of the mouth, and the right of the animal. The fin which runs along the back, begins above the eyes, and terminates about two inches from the tail; that upon the belly has its origin about ſeven inches from the point of the roſtrum, and terminates in the ſame manner. There are two pectoral fins and ſix ſmall ones on the belly †.

* Pleuronectes Hyppogloſſus, Lin. Syſt. Hyppogloſſus, Rondel.

† Vide Will. in Piſcem.

## *The Turbot* *.

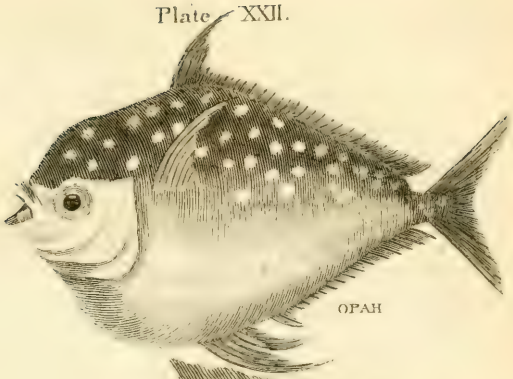
THIS ſpecies is excellent food, and grows to a great ſize, weighing from twenty to thirty pounds. The ſkin is entirely deſtitute of ſcales, but is granulated, and has different aſperities here and there diſperſed over it. The whole upper part of the body, together with the head and fins, is cinereous, and thick ſet with a variety of black ſpots. The jaws are not furniſhed with a ſingle row of teeth, as in the other congenerous fiſhes, but are exaſperated with a vaſt number of ſmall ones; as alſo the palate. The eyes are placed on the left ſide, not ſo near the edge of the back, nor ſo cloſe to one another, as in the reſt of the flounders. The dorſal fin takes its origin farther forward than uſual, beginning near the upper part of the mouth, and extending till it nearly reaches the tail †.

The turbot fiſhery is carried on to the greateſt extent on the north coaſts of *England* and of *Holland*. They are moſt ſucceſsfully caught by the hook and line; the method practiſed by ſtaked nets being very uncertain. The fiſhermen of *Scarborough* are moſt expert in their buſineſs. They go out in large cobles, with three men in each; and every fiſher has three lines, furniſhed with two hundred and eighty hooks apiece. The lines, before ſhooting, are all three joined together, when they extend about three miles, and are faſtened with buoys and anchors. They are drawn at every turn of the tide, the rapidity

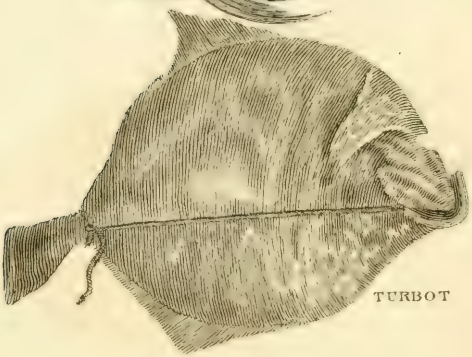
* Pleuronectes Maximus, Lin. Syſt. Le Turbot, Belon.

† Willough. p. 94.

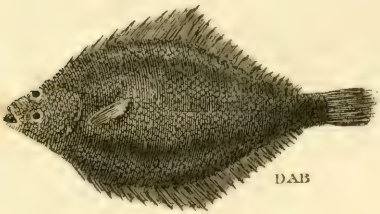
Plate XXII.



OPAH



TURBOT



DAB

SOLE

rapidity of the current preventing them at any other time *.

The bait moſt ſucceſsfully uſed for all kinds of ground fiſh, is herring, which are caught at all times during winter and ſpring in the *Channel*. Next to herrings, the leſſer lamprey is the moſt approved bait: The latter are frequently carried by land from *Tadcaſter*, at great expence; for though the flounders of ſome kinds are extremely voracious, they are ſo remarkably delicate with regard to a baited hook, that if a piece of herring has been twelve hours out of the water, they will not touch it †.

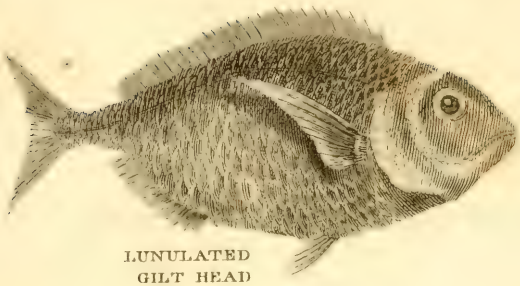
Of this genus there are no leſs than ten ſpecies known to frequent our ſhores: *viz.* the plaiſe, the common flounder, the dab, the ſmear dab, the ſole, the ſmooth ſole, the pearl, and the whiff: They are of various reputation as an article of food, and of every ſize, from half a pound to three hundred.

* Brit. Zoology. † Brit. Zool. Genus 23.

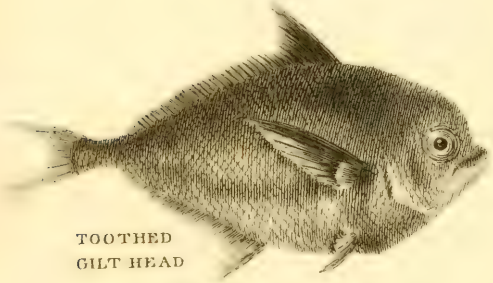
## Genus XXXIV.—*Chætodon.*

This genus consists of a tribe of no less than twenty-three different kinds of fish, all of them entirely exotic. Their generic characters are, an oval body, covered with very minute imbricated scales; a small flat head, with a declining rostrum; a single dorsal fin, covered with scales, and rising high above the back; two small pectoral fins; and immediately opposite, upon the thorax, two sharp pointed ventral ones. The tail is distinct from the other fins, scaly, and in some bifurcated *. As the fishes of this tribe are in general inhabitants of a different hemisphere, we shall not tire the reader with a tedious repetition of barbarous names, where the history of the animals to which they belong is altogether unknown.

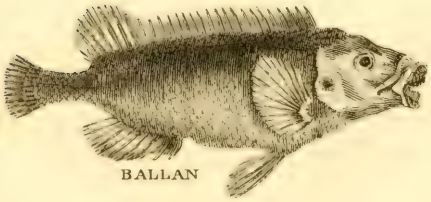
* Guan. Hist. Pisc. p. 138.



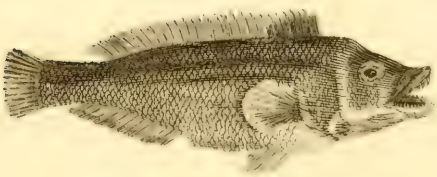
LUNULATED
GILT HEAD



TOOTHED
GILT HEAD



BALLAN



STRIPED WRASSE

## Section VIII.

### Genus XXXV.—*The Gilt-head.*

The fiſhes of this tribe are for the moſt part inhabitants of the *South Seas*, where they often relieved the want of the adventurous Captain *Cook* and his hungry companions. The body is of an oval ſhape, carinated, and covered with very ſlender ſcales: The head is compreſſed, ſcaly, and of a moderate ſize; the jaws are furniſhed with teeth, which are covered by the lips, the lower projecting beyond the upper. There is but one dorſal, and one anal fin; the pectoral are placed near the belly, and greatly ſharpened towards the end: the ventral fins are ſmaller, and placed ſomewhat behind them.

#### *The Lunulated Gilt-head*†.

This ſpecies is an inhabitant of the *Britiſh* coaſts, where it haunts the bold, rocky, and deep ſhores. The whole genus to which it belongs feed chiefly upon oyſters, and other ſhell-fiſh, which they comminute with their ſtrong teeth before they enter the ſtomach. The apparatus of



† Aurata, Rondelet. Sparus Lunula, Lin. Syſt.

the mouth is happily adapted for this purpoſe; for they are all furniſhed with flat back teeth, reſembling the grinders of quadrupeds, and fulfilling the ſame office. Beſides theſe teeth, and ſmall ſharp ones on the fore part of the jaw, the inner part of the mouth is lined with certain hard bones, which aſſiſt in the arduous work of grinding and maſticating their hard food *.

They are a coarſe fiſh, and in modern times held in no great eſteem, though the caprice of the ancient *Romans* ſet a high value upon ſuch as were fed with the oyſters of the *Lucrine* lake, perhaps for no other reaſon than becauſe they were faſhionable eating at a certain period: They ſeem, from *Martial's* account, to have thought meanly of theſe fiſh in general †.

The lunulated gilt-head grows frequently to the weight of ten pounds: The form of the body is deep, reſembling that of a bream; the back is ſharp, and of a duſky green; between the eyes is a ſemilunar gold-coloured ſpot; the ſides are of the ſame hue, but tinged with brown; at the farther angle of the coverts of the gills, there is frequently a black ſpot, below it ſometimes a purple one ‡. In this ſpecies the teeth are covered with lips; and the back teeth are not ſo flat as in ſome others of the genus. There is but a ſingle dorſal fin, which ſtretches a conſiderable way along the back, and has twenty four rays; the firſt eleven ſpinous, and the reſt cartilaginous: The three former rays of the ventral fin are alſo ſpinous, and the

* Brit. Zoology.

† Non omnis laudem pretiumque meretur,
Sed cui ſolus erit concha Lucrina cibus. Lib. xiii. Ep. 90.

‡ Willough. page 307.

the others ſoft. The pectoral fins are long, terminating in an acute angle; the tail has ſeventeen rays, and is much forked. In the winter ſeaſon, the gilt-head is caught in great abundance in the *Mediterranean*, and is frequently ſeen in all the fiſh-markets of *Italy*.

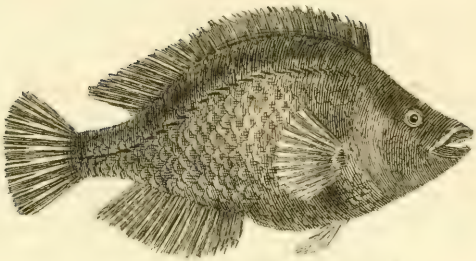
## Genus XXXVI.—*The Wraſſe.*

The fiſhes of this tribe are diſtinguiſhed by a flat and oval body; ſmall imbricated and reſplendent fins; a compreſſed head; double lips covering their long conic and blunt teeth. The coverts of the gills are ſcaly; the tail round; and one dorſal fin reaching the whole length of the back, having a ſlender ſkin extended beyond each ray; The anal fin is diſtinguiſhed by the ſame addition. The ſcari, ſo famous among the ancients, are of this genus: they were deemed ſuperior to the ſturgeon *. *Geſner* quotes from *Galen* high encomiums on the ſalubrity of their fleſh. *Ariſtotle*, *Pliny*, *Oppian*, and *Ovid*, all concur in a vulgar and unphiloſophical notion that was anciently prevalent concerning the rumination of theſe animals: The two firſt of theſe authors do not indeed pronounce with confidence, or aſſert upon their own knowledge a fact ſo extraordinary, but deliver it as a common opinion.

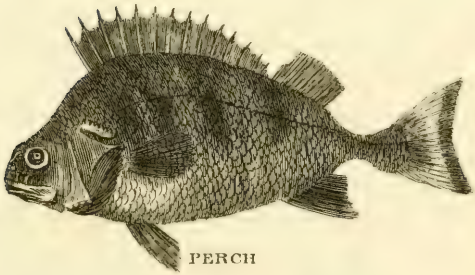
But whatever ideas the ancients entertained upon this ſubject, it is ſo contrary to the analogy of nature, for any of this claſs of the animal kingdom to chew the cud, that it merits no credit till confirmed by indubitable experiments. After examining the teeth, throat, and inteſtines of the ſalmon, ſcarus, gilt-head, and mullet, and all thoſe fiſhes that have been conſidered as ruminating, none of the

* Plinii, Lib. ix. c. 17.

Plate XXIV



GIBBOUS WRASS



PERCH

SEA PERCH

STICKLEBACKS

the requiſites for that proceſs are found to belong to them. Their food alſo is of ſuch a nature, that after the firſt comminution in the mouth, it has no farther occaſion to be brought back there to undergo a ſecond maſtication. *Pliny* indeed aſſerts, that the ſcari eat graſs and weeds; which, if true, would give a ſhew of probability to the rumination of theſe fiſhes; but unhappily the fact, in moſt kinds of theſe fiſhes, ſeems as ill founded as the opinion which it is adduced to ſupport †.

*Belon* ſeems to have adopted the notion of *Pliny*, as far as the food of the ſcarus is concerned; for he aſſerts, that it is only found around the iſland of *Crete*, the ſea in other parts not producing the marine plant upon which it ſubſiſts. *Geſner*, and ſeveral of the ancients, believed that this ſpecies, as well as ſome others, enjoyed intervals of ſleep in their ſubaqueous retreats; an aſſertion which receives no credit from the conformation of the eye; which being deprived both of eyelids and a nictating membrane, cannot poſſibly be ſhut ‡.

## *The Scarus* ¶.

THIS animal is of a reddiſh livid colour, covered with broad tranſparent ſcales, and diſtinguiſhed from every other fiſh, by certain prominent and tranſverſe appendages on each ſide of the tail. The mouth is not very capacious, but ſtored with obtuſe teeth; thoſe upon the fore

† Plinii. Hiſt. Nat. ubi ſupra. ‡ Geſner de Piſcib. p. 1019.
¶ Scarus, Belonii. Labrus Cretenſis, Lin. Syſt.

fore part reſembling the human, and fitted, as is ſuppoſed, for cutting the ſubaqueous plants upon which it feeds *. Along the back there is a ſingle fin, exaſperated by ſlender ſpines. The belly is furniſhed with four fins: In this ſpecies it is uncommonly large, and filled with juicy ſea-weeds. The inteſtines and liver are taken out, with all the feces, and made into a kind of ſauce, with ſalt and vinegar, with which the fleſh of the ſcarus is dreſſed and eaten. This is ſtill a favourite repaſt among the modern *Greeks*; who, when they ſet in for a debauch, take large morſels of this diſh, in order to give a more exquiſite reliſh to their wine. The ſcari are caught in nets, into which there are introduced a number of green leaves of a certain ſhrub, of which theſe animals are fond.

## *The Wraſſe* †.

THE uſual reſidence of our wraſſe is the deep rocky ſhores, where it is taken with a bait; though its ordinary food is ſmall cruſtaceous fiſhes. Of all fiſh, this is moſt liable to vary in colour; in ſome, it is of a dirty red; in others, it is beautifully ſtriped, eſpecially about the head, with the richeſt hues of red, blue, and yellow. The lateral lines, oppoſite to the extremity of the dorſal fin, are incurvated: This fin is ſupported by twenty-ſix rays; the firſt fifteen ſpinous, and the remainder ſoft. The pectoral fins are large, and yellow coloured; each of

* Willough. p. 306.

† Labrus Tinca, Lin. Syſt. Turdus Vulgatiſſimus, Will.

of the ventral has the firſt ray produced into a long ſpine; the three firſt rays of the anal fin are alſo ſpinous *.

The roſtrum of the wraſſe is protuberant, and bent upwards; and is farther lengthened by two thick fleſhy lips, one of which projects upwards, while the other hangs down. The teeth are ſerrated, the palate ſmooth, while the lower part of the mouth is full of prickly teeth.

The wraſſe commonly weighs from four to five pounds: In its general figure it reſembles a carp. Their fleſh is neither palatable nor nutritive. By the *French*, as well as the *Engliſh*, it is called the old wife, a name of which it is not eaſy to aſſign the origin. There are ſeven or eight diſtinct ſpecies of the wraſſe enumerated by Mr. *Pennant* among the *Britiſh* fiſhes; theſe, however, are characteriſed by differences ſo minute, that a particular deſcription of each would afford but little information †.

* Willough. p. 320. † Brit. Zool. Claſs iv. Gen. 25.

## Genus XXXVII. *Sciæna.*

The fiſhes of this genus are wholly exotic; and are characteriſed by an oval, compreſſed and carinated body: The ſcales are very minute, ſmooth, and towards the back and belly raiſed and looſe. The jaws are of unequal length, furniſhed with a great number of ſharp, incurvated teeth, that are covered by two thick lips. They have a ſingle dorſal and anal fin, with a looſe appendage beyond the rays: The ventral fins are placed on the thorax, a little behind the pectoral, and are ſharpened at the point *. A great part of the fiſhes belonging to this genus are black, and obtained the names of ſea-crows, ravens, and umbres, from the old naturaliſts. Some of them are peculiar to the *Braziliun* coaſts, where they are diſtinguiſhed by the original *Indian* names.

### *The Sea-Crow* †.

This ſpecies is of a black colour, in ſhape reſembling a perch; the ventral and anal fins are black, as if dyed with ink; the back variegated with undulating lines, of dark

* Guan. Hiſt. piſc. p. 140. † Coracinus, Rond. Umbra, Salviani.

dark brown and blue. The ſnout is ſharp; the mouth capacious, and inſtead of teeth is roughened with ſmall aſperities: around the roſtrum are various ſmall apertures; thoſe of the noſtrils wide, and placed near the eyes. On the back are two fins, ſo cloſely adjoining, that they appear ſingle and contiguous. The umbre, a ſpecies belonging to this tribe, is caught in the *Mediterranean*, and ſold in the markets of *Rome*, where it is called ombrino.

## Genus XXXVIII.—*The Perch.*

This genus comprehends no leſs than thirty-ſix different ſpecies, very few of which frequent theſe ſeas, and their hiſtory is on that account but imperfectly known. Only five kinds of the perch are found in the lakes and on the coaſts of *Britain*; the river perch, the ſea perch, the baſſe, the ruffe, and the black perch *.

Some ſpecies of this tribe have one, and others two dorſal fins; ſome have the tail bifurcated, which in others terminates in a ſtraight line. The body is generally oblong, laterally compreſſed, and covered with hard ſcales. The jaws are of unequal length, large, and arcuated; the teeth are incurvated, and arranged in ſeveral rows. The eyes are large and protuberant, covered with a nictating membrane, and ſituated at the brink of the forehead †.

Theſe animals are remarkably tenacious of life; ſome of them, particularly the river perch, have been carried fifty miles among graſs, and have ſurvived the journey. Their fins are ſo prickly, that they are ſaid to defy the attacks of the pike: this, however, is only true with regard to the larger perches, if it can be credited at all; for there is no animal which the pike will more readily devour than a ſmall perch. From the eaſe with which the river perch is taken and tranſported, it has become the

* Britiſh Zool. † Gunn. Hiſt. piſc. 141.

the moſt common inhabitant of our fiſh ponds, and affords a very wholeſome and palatable food.

## *The River Perch* *.

THE ancients were acquainted with this ſpecies; and among them it was deemed one of the firſt delicacies of the table.

Nec te, delicias menſarum perca, filebo
Amnigenos inter piſces dignande marinis. AUSONIUS.

*Rondeletius*, and after him *Geſner*, blames the phyſicians in his time for ordering the river perch to their patients in febrile diſorders, after a preſcription of *Galen*, who meant the ſea perch, a fiſh much lighter, as he alleges, and eaſier of digeſtion †. Experience, however, has ſhewn that this diſtinction is made without a difference; both the ſea and river kind being found equally palatable and ſalubrious. In the time of *Willoughby* this prejudice againſt the river perch had been forgotten: He approves of the taſte of *Auſonius*, in deeming the fleſh of this animal a great delicacy.

The river perch is eaſily caught with common earth worms, or ſmall frogs, for a bait; and is ſo voracious, that the angler, who falls in with a ſhoal of them, will ſometimes kill the whole. This ſpecies ſeldom grows to a large ſize, few being found above five or ſix pounds,



* Perca Fluviatilis, Rond. Une perche de Riviere, Belon.

† V de Rond. apud Will. p. 292.

the greater number being far inferior even to that magnitude. The body is deep and oval ſhaped; the ſcales rough; the back much arched; the ſide line nearer it than the belly. A minute deſcription of a fiſh ſo common would be unneceſſary.

## *The Baſſe* *.

This fiſh is diſtinguiſhed by an uncommon degree of voracity, and hence was termed a wolf (*lupus*) by *Ovid*†, a name generally adopted by ſucceeding writers. In the ſalt water pools of *Italy*, it ſometimes attains to a prodigious ſize, and weighs fifteen pounds; the fleſh is extremely grateful to the taſte‡: In the lakes they are frequently found by the fiſhermen frozen to death, as they ſuppoſe, but more probably ſuffocated by the excluſion of the air from the ſurface of the water; a circumſtance from which *Willoughby* takes occaſion to caution thoſe who keep them in ponds to break the ice frequently during the continuance of froſt §. This ſpecies inhabits indiſcriminately lakes, rivers, and the ſea; to the former, however, they probably aſcend from the ſea, for they do not ſeem to breed in freſh water.

Upon the back there are two fins, both radiated with ſpines: behind the anus another riſes and proceeds towards the tail, ſtrengthened with fourteen rays; the three firſt ſpinous: The pectoral and ventral fins have each a mixture of prickly and cartilaginous rays. The ſcales of

* Lupus, Rondel. Perca Labrax, Lin. Syſt.

† Halieut. p. 112. ‡ Rondelet. p. 268.

§ Ichthyol., p. 271.

of this fiſh are of a middle ſize, very thick ſet, and adhering cloſely to the body.

There are varieties of this ſpecies; ſome variegated, with dark ſpots, and others of an unmixed colour. The ruffe of the *Engliſh* belongs to this genus; it is the ſmalleſt of the tribe, and is found in our ſtreams, where it frequents the deepeſt parts of the water, and is remarkably gregarious; large ſhoals being found in the ſame pool. It is of a much more ſlender form than the perch, and ſeldom exceeds ſix inches in length.

## Section II.

### Genus XXXIX. *The Stickle-back.*

This genus is readily known by the formidable ſpines which riſe from the back of the greater part of the fiſh that compoſe it. There are eleven ſpecies enumerated in the ſyſtem of nature, three of which only are inhabitants of our rivers and ſhores; namely, that with three; that with ten, and that with fifteen ſpines upon the back. The former are ſeen in immenſe quantities in the fens of *Lincolnſhire*, and the rivers that flow from them. At *Spalding*, they appear once every ſeven or eight years, in the *Welland*, where they mount the river in ſuch vaſt columns, that they are uſed in manuring the land. An idea of their numbers may be formed, from a circumſtance mentioned by *Pennant*, of a man earning four ſhillings a-day by taking and ſelling them to the farmer at an halfpenny a buſhel *. The cauſe of theſe temporary migrations of the ſtickle-back, is ſuppoſed to ariſe from the vaſt quantities waſhed out of the fens by the floods, and collected in ſome deep hole, till overcharged with numbers, they are obliged periodically to attempt a change of habitation.

The body is oblong, compreſſed, and frequently covered with rough ſcales. The ſnout is long; and the mouth thick ſet with ſmall granulated teeth. There is one dorſal, and one anal fin; the pectoral are ſmall, and ſharp pointed, ſituated upon the thorax, which is covered with *ſcuta* or bony plates.

* Britiſh Zoology, Claſs iv. gen. 28.

## *The Three-Spined Stickle-Back* *.

This ſpecies is broad, and compreſſed laterally: it ſeldom exceeds two inches and a half in length; is of an olive green upon the back; the belly white: In ſome the throat and belly are red. Before the dorſal fin there are three ſharp ſpines which can be raiſed or depreſſed at pleaſure; behind the anus there is one, ſometimes two, ſtill ſtronger, which are fixed to a bony plate. The ten-ſpined ſtickle-back is of a ſtill ſmaller ſize, and a more ſlender form; the ſides are ſmooth, not plated as in the preceding ſpecies. The fiſhers aſſert, that this animal is produced ſpontaneouſly, and from them fiſhes of various kinds: The foundation of this extravagant notion, is their obſerving them in ponds newly dug, where, in the courſe of a few years, different fiſh have been found. We have already aſſigned our reaſons for theſe appearances, without having recourſe to ſuch an ill-founded hypotheſis †.

## *The Fifteen-Spined Stickle-back* ‡.

Schonfeldt firſt deſcribed this animal, which is an inhabitant only of the ſea, and is much larger than any of the two

* Gaſteroſteus aculeatus, Lin. Syſt. Stickle-back, or Sharpling, Will.

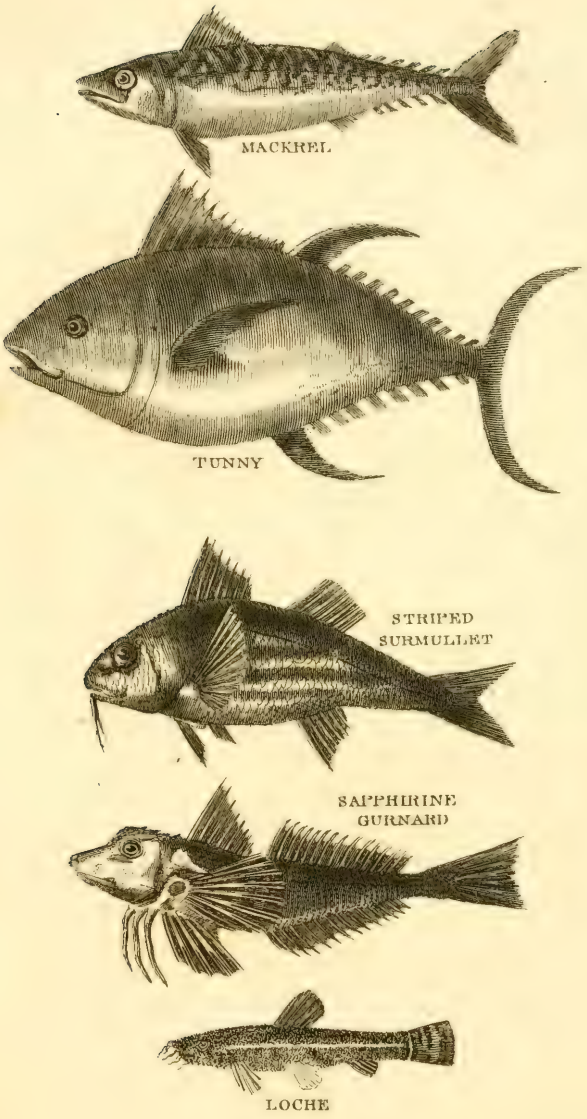
† Vide Chap. i. ſect. 4. Of the generation of fiſhes.

‡ Aculeatus marinus major, Will. Gaſteroſteus Spinachia, Lin. Syſt.

two preceding. The body is ſlender, being only an inch thick, and nine long; towards the tail it is quadrangular, and extremely ſmall: The whole ſkin is ſmooth; black upon the upper part, and ſilvery upon the lower. It has two pectoral fins, one dorſal, riſing in a triangular form from the middle of the back; between which and the head there are fifteen unconnected ſpines, inclining a little towards the tail; on the middle of the belly there are two, at the anus one: The fins of the belly are wanting. The ſpecies inhabits the *Baltic* and *German* ocean, particularly the coaſts of the *Netherlands*; it is called ersſkrupper. *Willoughby* is miſtaken in ſuppoſing that it is never found on the coaſts of *Britain* *.

* Ichthyolog. p. 340.

Plate XXV.


MACKREL
TUNNY
STRIPED
SURMULLET
SAPPHIRINE
GURNARD
LOCHE

## Genus XL.—*The Mackrel* *.

This is one tribe of thoſe ſhoals of migratory fiſhes, which annually viſit our coaſt; and it is perhaps among the moſt celebrated of that claſs, both for its numbers and the delicacy of its food. They are gregarious in their habits; and while other fiſhes continue in our vicinity all the year round, and proul along the ſhore in ſmall numbers, or ſolitary, theſe in a compact band viſit their accuſtomed haunts at ſtated ſeaſons with ſo much regularity, that you can pronounce with certainty the time of their appearance.

What impels the mackrel and other migratory fiſhes to undertake ſuch diſtant voyages, what directs their courſe, and what ſupports them upon their paſſage, are ſubjects on which naturaliſts have indulged in all the licence of conjecture, without being able to form any ſatisfactory determination. Some have imagined, that we owe the viſits of the whiting, the haddock, and the mackrel, rather to their fears than their appetite; and that they are driven upon our coaſts in endeavouring to avoid the purſuit of their deſtroyers. It is, however, more probable, that they approach the ſhore in queſt of food, which is found in greater plenty there than in the depths of the ſea †.



* Scomba, Rondel. Scomba, Scomba, Lin. Syſt.

† Goldſmith's Nat. Hiſt. vol. vi. p. 326.

It is to be regretted, that the mackrel, though perhaps the moſt palatable of all the gregarious fiſhes, is leaſt uſeful, owing to its extreme tenderneſs, and inaptitude for carriage: It is capable, indeed, of being preſerved by pickling and ſalting; a method, which we are ſurpriſed to find is only practiſed in *Cornwall*, where this food proves a great relieve to the poor during winter *.

The ancient *Romans* were juſt to the merits of this fiſh; for among them it was held in high eſteem, eſpecially on account of the *garum*, a celebrated pickle, that gave a high reliſh to their ſauces, beſides being medicinally uſeful †. According to *Belon*, this precious pickle is ſtill in faſhion at *Conſtantinople*. Formerly it was prepared from different kinds of fiſhes; but that procured from the mackrel was deemed preferable: The beſt was made at *Carthagena*, vaſt quantities of mackrel being taken near an adjacent iſle, called from that circumſtance *Scombraria* ‡.

The mackrel is eaſily taken, by a variety of baits; but the capture always ſucceeds beſt during a gentle gale of wind: a coloured feather, or a piece of ſcarlet cloth, is often found ſufficient to allure theſe dim-ſighted animals to deſtruction. In ſpring their eyes are covered with a white film, which renders them half blind, till it is caſt ſome time in the ſummer.

This fiſh is probably found in all the *European* ſeas, being univerſally known in that quarter of the globe. It ſeldom exceeds two pounds weight in the common ſpecies, and its body is of a very elegant form, and beautifully variegated

* Borlaſes Cornwall, p. 269. † Plinii, Lib. xxxi. cap. 8.
‡ Strabo, Lib. iii. p. 109.

variegated with the fineſt hues of green, blue, and ſilver *. The common mackrel is from a foot to a foot and a half; the body thick, round, and fleſhy, but tapering to a ſlender point as it approaches the tail, which is bifurcated. The ſcales are ſo ſmall as to be hardly perceptible; behind the anal and ſecond dorſal fin there are ſeveral protuberances or ſpurious fins, both above and below †: Theſe may be deemed the diſtinguiſhing marks of this animal, which is too well known to require a more particular deſcription.

## *The Tunny* ‡.

THIS ſpecies is well known in the *Mediterranean*, which they annually enter from the *Atlantic* ocean; and are taken by the inhabitants of the coaſts of *Spain* and *Italy* as they advance. They were ſuppoſed by the ancients to breed in the *Levant*, and *Palus Mætis*. Some of them grow to an immenſe ſize, weighing above four hundred pounds; a magnitude which ſeems altogether incompatible with the ſhort life which the ancients allotted to theſe animals: Both *Pliny* and *Ariſtotle* aſſert, that two years is the utmoſt period of the life of a tunny §.

A very extenſive tunny fiſhery was carried on by the ancients in the *Mediterranean*; particular ſtations being



* Britiſh Zoology, gen. 29. † Willough. p. 181.
‡ Thunnus, Rondel. Scomber Thunnus, Lyn. Syſt.
§ Hiſt. Anim. Lib. ii. cap. 13.

fixed upon for that purpoſe, near ſome promontory *, where a man was placed to give notice of the motions of the fiſh, and warn the fiſhermen below. It is from one of theſe precipices, that the lover in *Theocritus* threatens to leap, with a view of ſoftening the rigour of his miſtreſs's cruelty †. The manner of taking the tunny in nets, as it is at preſent practiſed, is perhaps ſimilar to that of the ancients; many of the fiſhing ſtations are exactly the ſame. The trade is ſtill carried on to a great extent: when taken, the fiſhes are cut into pieces and ſalted up in barrels, in which ſtate they are exported to all the neighbouring countries. The abdomen is reckoned by far the moſt delicate part of the fiſh: it is cut ſeparately, and ſold to the nobility and wealthy citizens of *Rome*, under the name of taremtello ‡.

The tunny frequents the *Engliſh* coaſts, but not in the ſame numerous ſhoals that are ſeen in the *Mediterranean* §. It is alſo pretty common in the lochs on the weſtern coaſts of *Scotland*, where it comes in purſuit of herring, and often during night ſtrikes into the nets, to the great damage of their owners. In the morning, when the nets are drawn by the fiſhers, the tunny watches near them, for any fiſh that may chance to drop out. The fiſhermen avail themſelves of this avidity for prey in the tunny, and baiting a hook with a herring, they ſeldom fail to take him.

The fleſh of the tunny, when recently taken and cut up, has the appearance of raw beef; but after boiling, it turns pale and taſtes like ſalmon. They are about eight feet

* Theſe were termed Θυννοσκοπεῖα.

† *Vide* Idyllia.

‡ Vide Salvian. apud Will.

§ Britiſh Zool.

feet in length, the body round, thick, and fleſhy; but growing ſlender towards the tail, where it has an angular ſhape. The two fins on he back are each ſtrengthened by fourteen ſtrong ſpines; thoſe of the firſt are capable of being depreſſed, and folding ſo cloſely into a ſulcus in the back, that they become imperceptible. Behind the anal and ſecond dorſal fin, there are a number of ſmall ſpurious ones both above and below.

## GENUS XLI.—*The Surmullet.*

THIS genus comprehends the three ſpecies of mullets; all fiſhes of the moſt delicate kind: ſome of them were in ſuch requeſt among the *Romans*, that they were bought by the private citizens for their weight of ſilver. It was in the purchaſe of this fiſh, above all others, that the wealthy ſenators ſhewed their extravagance and ſenſuality. *Juvenal* and *Pliny* afford ample teſtimony of the luxury of their age, which, happily for mankind, has never been equalled in any other period of human ſociety *. An inſtance of ſixty-four pounds being paid for a fiſh of three pounds weight, is recorded by *Pliny* †.

But the manner of dreſſing and eating theſe fiſh, ſtill more than the extravagance of the price, ſhewed the epicuriſm of the ancient entertainments. The mullet was not reckoned worth a farthing if it did not die in the hand of your gueſt. There was water kept in the eating room into which the living animal was put, and from thence conveyed immediately to the ſtew, where it was dreſſed, which was alſo in the ſame apartment, and under the table; from thence the fiſh was placed upon it.

It

* Mullum ſex millibus emit, Æquantem ſane paribus ſiſtertia libris. This ſum is equal to 48l. 8s. 9d. Juv. Sat. xv.

† That of Aſinius Celer, a man of conſular dignity, Vide Lib. xx, cap. 17.

It was cuſtomary to put the mullets into glaſs vaſes, that the company might be entertained with the various changes of their rich colours as they lay expiring *. It was *Apicius*, that prince of gluttons†, that firſt hit upon the ingenious invention of ſuffocating them in the exquiſite *Carthaginian* pickle, and afterwards procuring a rich ſauce from their livers.

## *The Striped Surmullet* ‡.

THERE are three ſpecies of this genus, the red and the ſtriped, which are ſometimes found in the *Britiſh* ſeas, and the king of the ſurmullets, a fiſh peculiar to the *Mediterranean*, and deſtitute of the two *cirri* which hang from the chin of the other ſpecies. The ſtriped ſurmullet is about fourteen inches in length, and weighs about two pounds and an half. The body is thick; the ſnout blunt, and from the lower ſide of it hangs two beards, about an inch and an half long. The fins are of a beautiful red, and yellow; the colours of the body vary in their hues, into a thouſand different ſhades, while the animal is dying.

* Vitriis ollis incluſi offeruntur, et obſervatur morientium color, quem a multas mutationes luctante ſpiritu vertit. Seneca, Nat. Quæſt. lib. 3.

† Nepotum omnium altiſſimus gurges. Pliny, lib. x. c. 48.

‡ Mullus major, Will. Mullus Surmuletus, Lin. Syſt.

## GENUS XLII.—*The Gurnard.*

THE diſtinctive characters of this tribe, called by *Linnæus* trigla, are, a ſcaly body, of an uniform ſhape, compreſſed laterally, and attenuated towards the tail. The head broader than the body; and ſloping towards the ſnout, where it is armed with ſpines; the upper jaw divided, and extending beyond the lower. The eyes are far from the roſtrum, near the top of the head large and prominent, particularly the upper margin of the orbits. The two dorſal fins are unequal; the firſt ſhort, high, and aculeated; the ſecond, long, ſloping, and radiated. The ventral and pectoral fins are uncommonly large; and from their baſe there hang three looſe and ſlender appendages *.

To this genus belongs the flying fiſh of the ſailors, or trigla volans of *Linnæus*, remarkable for the length of the pectoral fins, which it ſometimes uſes for the purpoſe of flying. There are two ſpecies of the gurnard that participate in this manner the powers of the feathered race; they are both found only in warm latitudes, and nature has probably vouchſafed them this endowment, to enable them to eſcape from their numerous purſuers below. It is a curious ſpectacle in the intratropical regions to behold a thouſand of theſe fiſhes, all darting

* Guan. Hiſt. piſc. p. 148.

darting from their native element; and while they endeavour to avoid the purſuit of the dolphin below, falling into the power of enemies ſtill more dextrous and inveterate in the aereal element. The flights of theſe ambiguous animals are but ſhort; for as ſoon as their wings dry, they drop back into the ſubjacent waves without a poſſibility of riſing till they are again wetted there: It is from the ſudden drying of their wings, that they often fall upon the decks of veſſels, particularly thoſe that double the *Cape of Good Hope*. Theſe fiſhes are ſeen in the *Mediterranean*, but ſeldom venture farther from the line; none of thoſe that frequent the *Britiſh* ſeas are capable of riſing from their native element *.

## *The Gray Gurnard*†.

THE colour of this fiſh, upon the back, is a dirty green, variegated ſometimes with black, but more frequently with clay-coloured ſpots: Below the lateral line, which is remarkably rough, the colours are more diluted, and the white ſpots more frequent, till you approach the belly, which is ſilvery. The head is large, covered with bony plates, of which the higheſt that covers the top of the head, runs backwards, and terminates in two ſharp horns or ſpines. The ſnout, and upper part of the eyes, are alſo fortified in the ſame manner by ſpines. The



* *Vide* Willough. et Marcgr. de piſcib. Bray.

† Gurnardus Griſeus, Will. Trigla Gurnardus, Lin. Syſt.

jaws, and the whole inner part of the mouth, are covered with very ſmall teeth. The eyes are large; the irides of a ſilver colour, with a tincture of brown: The noſtrils are ſmall, and placed on the ſides of the roſtrum: On the extremity of the gill covers, is a thick, ſharp, and long ſpine. The firſt dorſal fin conſiſts of eight ſpiny rays; the ſides of the three firſt tuberculated: The ſecond has nineteen rays, and is lodged, like the former, in a groove, rough on each ſide. The pectoral fins are long and tranſparent, and ſupported by ten rays; from their baſe hang three beards*. The *Britiſh* fiſhes of this genus are, the tub fiſh, the ſeraphine, the ſtreaked, the gray, and red gurnard, and the piper; the laſt, *Rondeletius* has termed the lyre, on account of its bifurcated roſtrum, which ſomewhat reſembles that inſtrument among the ancients. The whole of this genus is excellent food.

* Britiſh Zoology, gen. 31.

## Division IV.—*Abdominal Fiſhes.*

### Section X.

### Genus XLIII.—*The Loche.*

We are now come to the laſt diviſion of the ſpinous fiſhes, termed by naturaliſts, the abdominal, from the ſituation of their ventral fins, which are placed far behind the pectoral in the abdomen. The loche, or cobitis of *Linnæus*, which is placed at the head of this tribe, is perhaps the moſt unſhapely of the whole race. The body is compreſſed laterally, and nearly of the ſame depth from the head to the tail: It is deſtitute of that ſymmetry and elegant tapering form, which is characteriſtic of the greater part of fiſhes. The ſcales are deciduous, and ſo ſmall as ſcarcely to be perceived. The back is marbled with brown ſpots, upon a paler ground of the ſame colour; the belly, a dirty white *.

*Linnæus* has five ſpecies, that are peculiar to our rivulets. The loche ſeldom attains to the ſize of four inches; and is rendered hideous by a beard that projects all round the ſnout. Forbidding, however, as this animal may ſeem, we are told our ſportſmen ſometimes ſwallow it down alive in a glaſs of wine †.



* Gunn. Hiſt. Piſcium, p. 205. † Britiſh Zoology.

The body is ſmooth and ſlippery, and almoſt of equal thickneſs; the two dorſal and caudal fins are marked with ſmall ſpots, the latter ſomewhat rounded, and barred with ſtripes of black. This diſguſting fiſh, which conſtantly crawls at the bottom of our rivers, is by ſome reckoned a delicate food, when made into a kind of ſauce. They generate commonly in the month of April, among the long aquatic weeds about the brink of the rivers †.

† Willough. page 265.

## Genus XLIV. *Amia.*

Of this genus there is only one ſpecies, diſtinguiſhed by the baldneſs of the forehead, which appears as if excoriated. The body is ſlender, a little compreſſed, and covered with imbricated and flexile ſcales; the head is bony, rough, and flattened; the jaws of equal length, and furniſhed with a number of ſharp erect teeth; the tongue is obtuſe; the palate armed with two teeth; near the eyes are two apertures of the noſtrils; and not far from them are two beards.

There is only one dorſal fin riſing from the middle of the back, radiated and ſloping; the ventral and pectoral fins are ſmall; the former placed behind the equilibrium of the fiſh, in the abdomen. The tail is rounded, ſupported with rays, and ſhort ||.

|| Guan. Gen. Piſcium, p. 208.

## GENUS XLV. *Silurus* *.

A VARIETY of exotic fiſhes are contained in this tribe; that which we ſelect for deſcription is found in the *Danube* and *Viſtula*, ſometimes in the *Rhine*, and the lakes of *Germany*. It grows to the length ſometimes of ſixteen feet, and weighs an hundred and fifty pounds. At *Vienna*, *Willoughby* obſerved them of this prodigious bulk †. The belly ſeems as if worn by continual rubbing on the ground, whence it is probable that the ſilurus frequents the bottom of the water. It is extremely voracious, and deſtructive to other fiſh wherever it appears: by many it is commended as an article of food, when ſkilfully dreſſed.

This animal reſembles the eel in colour, and that viſcous ſubſtance with which the body is covered. The belly and ſides are variegated with large ſpots of black and white, and the whole is deſtitute of ſcales. The head is broad, and much flattened. When the jaws are open, the gape of this fiſh is tremenduous; for it extends almoſt the whole length of the head. Before the eyes there are two antennæ, reſembling the feelers of inſects, and probably deſtined to ſerve the ſame purpoſe. From the under lip, there hang four ſimilar feelers, which the animal is ſaid to caſt annually ‡.

The

* Silurus Rondel. The Sheat-fiſh, Will.

† Ichthyology, page 128. ‡ Vide Geſnerum apud Will.

The dorſal fin is ſmall, having only three rays; from the anus to the middle of the tail, there is a very long fin, ſupported by twenty rays; the pectoral fins have each a ſtrong ſpine projecting from the firſt ray, which the animal probably uſes as an inſtrument of defence.

## Genus XLVI.—*The Teuthis.*

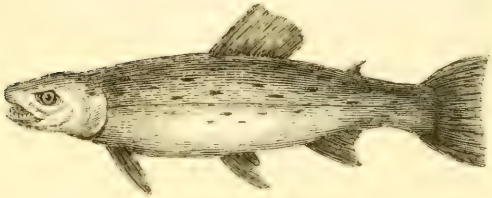
The two ſpecies which *Linnæus* has arranged under this genus are both exotic fiſhes. The generic characters are, a cylindrical body, covered with tuberculated ſcales, which give the animal ſomewhat of an angular ſhape. Theſe ſcales are thinly ſet, ſcarcely imbricated, and are extremely rough to the touch. The head is broad, flattened horizontally, and ſloping towards the ſnout, which is obtuſe. The mouth is deſtitute of teeth; the eyes diſtant from the ſnout, placed almoſt on the top of the head, and covered with an entire nictating membrane. On the inner ſide of the lips are innumerable cirri, which ſerve the animal inſtead of teeth *.

A *Braſilian* fiſh, termed by the natives guacari, belongs to this genus. The fins are in general ſupported by very ſtrong ſpines. The tail, which in the lower diviſion is about three inches in length, and two in the upper, is ſupported by very ſtrong ſpines. The whole head is covered with a rough kind of ſhell; the ſcales of the body triangular, and arranged in rows, forming a ſtrong coat of mail, well adapted for defence †. The whole body of this fiſh is of a ſafron colour, diluted towards the belly, but deep upon the ſides and back; over this ground there is diſperſed an innumerable quantity of ſmall brown ſpots, reſembling muſtard ſeeds. The native *Braſilians* eat this fiſh; but after the bulky tegument is ſubtracted, very little fleſh remains, and that of no exquiſite quality.

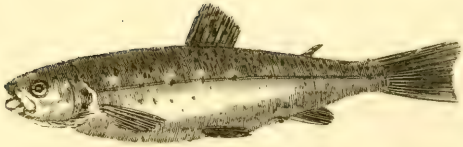
* Guan. Hiſt. Piſcium, p. 188. † Willough. page 277.

Plate XXVI

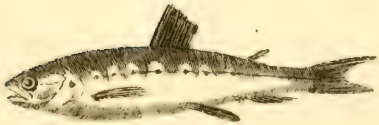
SALMON



SALMON TROUT



TROUT



SAMLET

## GENUS XLVII.—*Salmon.*

THIS family contains ſeventeen ſpecies, many of which are perfectly familiar to the inhabitants of this iſland, being found in all its lakes, rivers, and ſhores. The moſt remarkable for beauty and utility is the common ſalmon, whoſe external figure may vie in elegance with that of any fiſh that ſwims, and whoſe fleſh is well known over all *Europe* for its agreeable taſte and nutritive quality.

A minute deſcription of the parts of the common ſalmon would be ſuperfluous. It is found over all the north of *Europe* and *Aſia*, from *Britain* to *Kamſchatka* *; but does not venture into the warm or intratropical latitudes. It is frequent as far north as *Greenland*, and is ſeen in ſome of the rivers of *France*; but none have been caught ſo far ſouth as the *Mediterranean* †.

The ſalmon is an ocean fiſh, and therefore is only found in thoſe rivers and lakes that communicate with the ſea. As the ancient *Grecians* never extended their empire to the ocean, they were unacquainted with this excellent fiſh; and hence their language has no name to diſtinguiſh it ‡. The extent of the *Roman* territory gave them many opportunities of being acquainted with the ſalmon; and in their language it has a name from which ours is borrowed; the word ſeems to expreſs its bounding or leaping ||.



* Hiſt. of Kamſch. p. 145.
† Rondel. Fluvial. 167.
‡ Geſner, apud Will. p. 189.
|| A Salio ut videtur.

Among ſeveral nations the ſalmon has different names, according to the age of the fiſh. The ancients diſtinguiſhed them into *ſalmones*, *farriones*, and *ſalares*, according to their age *. In *England*, the inhabitants of *Yorkſhire* call thoſe of the firſt year, ſmelts; of the ſecond, ſprods; of the third, morts; of the fourth, fork-tails; and of the fifth, half fiſh; for it is not till the ſixth year that this animal attains its full ſize.

There are ſalmon-fiſheries in *Iceland*, *Norway*, and *Lapland* †; but no where are they carried on to greater extent than in *Britain* and *Ireland*; the fiſhery of *Colraine* in the latter kingdom being an inexhauſtible fund of proviſion and of wealth.

The long migrations of the ſalmon at the ſpawning ſeaſon is, perhaps, the moſt extraordinary part of its hiſtory. It annually mounts rivers, ſometimes to the diſtance of ſeveral hundred miles, till it finds a place in their gravelly bed, fit for depoſiting the ſeeds of a future family. There are hardly any obſtructions which it will not overcome, to attain this purpoſe. It eaſily makes its way againſt the moſt rapid current, and will leap up cataracts of an aſtoniſhing height. In endeavouring to ſurmount theſe perpendicular falls, it often fails in the attempt, and tumbles back into the water, and thus is in ſome places caught in baſkets placed below the current.

The manner of depoſiting their ſpawn, after having performed theſe arduous journies, is curious. When a proper place is ſelected for the purpoſe, the male and fe-

2 male

* Teque inter geminas ſpecies neutrumq. & utrumque,
Qui nec dum Salmo, nec jam Salar, ambiguuſque;
Amborum, medio Fario, intercepte ſub ævo. Ausón.

† Hackluyt, Voy. I. 416.

male unite in digging a pit of eighteen inches deep, into which the former ejects his ſmelt, and the latter her ſpawn: The place is carefully covered up with their tails, which at that period are worn bare. In this ſtate, the ſpawn lies buried from December till Spring, if not diſturbed by violent floods; while, in the mean time, the parent fiſhes haſten back to purify and ſtrengthen themſelves in the ſea; for, after ſpawning, they are lean and flabby. It is when they firſt leave the ſea that they are plump and vigorous; and ſuch as are in that condition have a number of inſects adhering to them above the gills *.

About the latter end of March, the ova begin to exclude the young ſalmon, which are then reſuſcitated, and ſwarm in numbers, of which it is difficult to form any idea. They are then termed fry in *Scotland*, and ſmelts in the ſouth of the iſland; and they remain in the freſh water till the arrival of a flood, by which they are ſwept down into the ſea. In June, the young ſalmon begin to appear again in the rivers, in dropping ſingle fiſh: there they increaſe with amazing rapidity in ſize; for in June, when they appear firſt in the rivers, they are only about a foot or fourteen inches in length; and in Auguſt ſome are ſeen eight and nine pounds.

The quick growth of the ſalmon is by no means occaſioned by the voracity of theſe fiſh; for all the fiſhermen agree, that no food is ever found in their ſtomach. Perhaps this may be owing to a temporary neglect of food about the ſeaſon of ſpawning or fecundation, as is the caſe with the ſea-lions. It is well known that the



* The Iernæ Salmoneæ, Lin. Syſt.

angler takes them fuccefsfully with the fly, the worm, or fmall fifh, an evident proof that thefe are the animals on which they feed.

At *Berwick* on the river *Tweed*, the capture of the falmon is immenfe during the month of July. At that feafon, they are falted, and barrelled up for exportation: Even the immenfe confumption of *London* not being able to keep pace with the vaft loads that are daily taken.

Upon the *Tweed* there are above forty different fifheries, extending about fourteen miles up the river, which are rented at the fum of 5400 l. annually: The expence of fifhing-tackle, fervants wages, and other requifites, amount nearly to an equal fum; fo that upwards of 10,400 l. muft be obtained by the different leffees, before they can clear their expences; and hence, 208,000 falmon muft be caught there, upon an average, every year, before any profit can accrue to the tenants.

The fifhing feafon commences on the 30th November, and ends on Michaelmas day. The corporation of *Berwick* are confervators of the fifhery, part of which belongs to that town. The river being the boundary of the two nations, the whole north fide is *Scotch* property *.

The rivers both of *Scotland* and *Ireland* abound with thefe fifh; and a pretty extenfive capture is made in fome of them. The mode of preferving them is nearly the fame with that practifed in *Berwick*, and the markets are fimilar; for in thefe kingdoms they begin to export during the fummer months, after the *London* market is fupplied. Very fevere laws were enacted in *Scotland* for the preservation of falmon. So late as the reign of *James*

* Vide Britifh Zoology, Gen. xxxiii.

*James* IV. killing this fiſh was made capital after the third offence; before that period, the culprit might redeem his life *.

Various cauſes have of late operated to the prejudice of the *Britiſh* trade in this important article. The great increaſe of the *Newfoundland* fiſhery has reduced the price of ſalmon in the foreign markets, while the gradual increaſe of knowledge throughout *Europe* has led to a much greater relaxation in the diſcipline of the *Romiſh* church, and particularly in the article of abſtinence; a regimen which is daily loſing credit as a ſpiritual reſtorative. And to theſe circumſtances we may alſo add, the great improvement in agriculture that has every where taken place in theſe kingdoms within the laſt fifty years; which, by the frequent application of lime upon the ſoil, has probably greatly diminiſhed the number of ſalmon, as well as of other river fiſhes.

## *The Sea-trout* †.

This ſpecies is larger than the common, and differs from it in its habits and colour, as well as in ſize. It annually migrates like the ſalmon, from the ſea; and after having depoſited its ſpawn, it again returns to its favourite reſidence in the ocean. The ſhape is more thick than that of the river-trout, and its weight ſometimes above three pounds.

* Vide Regiam Majeſt. Rob. III. cap. 7.

† Salmo Trutta, Lin. Syſt. Trutta Salmonata, Will.

pounds. It differs from the ſalmon, in having the tail terminating in a ſtraight line. The head is thick, ſmooth, and duſky; the back is of the ſame colour, but grows fainter towards the ſides, which are marked with large irregular ſpots of black. The fleſh, when boiled, is paler than that of the ſalmon, but grateful to the taſte *.

Another ſpecies, or perhaps variety, of the trout, is the ſamlet, the ſmalleſt of the kind, and by ſome accounted the fry of the ſalmon at a particular ſtage of their growth: but as this ſpecies remains in the rivers after the departure of the young ſalmon, and is of a much ſmaller ſize than they are after their return, the inference is obvious, that it muſt belong to a different tribe. It nearly reſembles the river-trout; but may be diſtinguiſhed by a broader ſhape; by its ſuperior whiteneſs, and by the ſhape of its tail, which is more forked; and, laſtly, by the ſmallneſs of its ſize, which is much inferior to that of the trout †.

## *The River-Trout* ‡.

THE common trout is a fiſh univerſally known in this iſland, for the delicacy of its fleſh, for the ſport it affords to the angler, and for the ſuperior beauty of its colours. The common ſpecies it is unneceſſary to deſcribe; but there are ſome varieties not unworthy of notice. The colours of the trout vary greatly in different waters: In *Llyndivi*,

* Willough. † Brit. Zoology, Gen. 33.
‡ Salmo Fario, Lin. Syſt. A Trout, Will.

*Llyndivi*, a lake of *South Wales*, are trouts marked with red and black ſpots, as large as ſixpences. In *Loch Neagh* in *Ireland*, and *Hulſe Water* in *Cumberland*, there are trouts taken which weigh about thirty pounds. Theſe are probably of the ſame ſpecies with the celebrated trout of the lake of *Geneva*. The ſize alone of theſe fiſhes can recommend them; for in taſte and flavour they are all inferior to our common river-trout.

It is remarkable that neither the *Greek* nor *Roman* authors make any mention of this fiſh, and that a ſpecies of ſuch delicacy ſhould never have become a faſhionable diſh. In the *Italian* rivers the trout abounds, and in all probability did ſo at the time when the *Romans* were tranſporting oyſters from *Sandwich* *, and the livers of the ſcari from the coaſt of *Africa* †. But it was perhaps owing to its proximity of ſituation, and to the eaſe with which it might be procured, that the trout was deſpiſed by the votaries of *Epicurus*, who ſcrupled not to laviſh a large fortune on a diſh of flammingo's tongues, and other inſipid rarities ‡.

It is the voracity of the trout that leads the way to its deſtruction, and makes it a prey to the inventions of the angler. The paſſion for angling is ſo great, that in the neighbourhood of *London*, ten pounds a year is the ſum paid for the liberty of fiſhing in ſome of the adjacent rivers.

But there is a ſmaller fiſh in ſome parts more plentiful than the trout, which affords ſuperior diverſion to the ſportſman, and that is the parr, a fiſh of remarkable beauty, and elegant proportions. This beautiful ſpecies is

* Juven. Sat. iv. 141.

† Suetonius in Vita Vitellii.

‡ Martial, Lib. xii. Epig. 71.

is a well known inhabitant of the greateſt part of thoſe pure and rapid ſtreams which deſcend from the mountains in the *Highlands* of *Scotland*, where we have witneſſed above twelve dozen taken with a ſingle rod and line in a few hours.

## *The Charr* *.

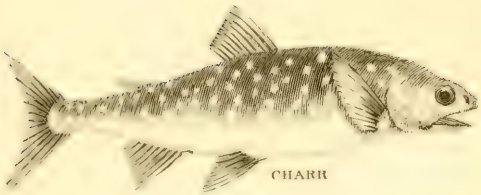
This ſpecies is very properly denominated the *Alpine* charr by *Linnæus*; for its conſtant reſidence is in the lakes of the high and mountainous parts of *Europe*. A few are found in ſome of the lakes in *Wales*, and in *Loch Inch* in *Scotland*; from which laſt it is ſaid to migrate into the *Spey* to ſpawn: ſeldom, however, does this ſpecies venture into any running ſtream; its principal reſort is in the cold lakes of the *Lapland Alps*, where it is fed by the innumerable larvæ of gnats that infeſt thoſe dreary regions. When the *Laplanders* migrate to the diſtant lakes during ſummer, they find a ready and luxurious repaſt in theſe fiſhes; which to them are extremely palatable without any ſauce: accuſtomed to temperance, and exerciſe, theſe hardy natives are independent of the inventions of epicuriſm †.

The largeſt and moſt beautiful charrs are found in the lake of *Winander-Mer*, in *Weſtmoreland*, where there are three

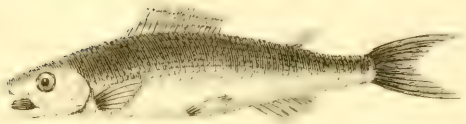
* Salmo Alpinus, Lin. Syſt. Umbla minor, Geſner.

† Britiſh Zoology.

Plate XXVII.

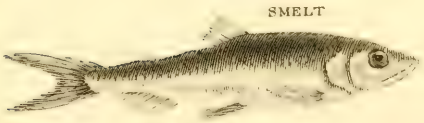


CHARR



GRAYLING

GWINIAD



SMELT

three ſpecies, the red, and the gilt, and the caſe-charr. Theſe kinds are nearly ſimilar in their external appearance; but the time and manner of their ſpawning are ſo different, as to afford room for their ſpecification into three diſtinct families. The caſe-charr ſpawns about *Michaelmas*, and chiefly in a river that runs into the lake called the *Brathy*. The ſpawning ſeaſon of the gilt charr is from the beginning of *January* to the end of *March*: they never aſcend the river; but make choice of a ſpringy part of the lake, where the bottom is ſmooth and ſandy *.

The figure of the charr is more ſlender and lengthened than that of the trout: The colour of the back is an olive green, variegated with ſpots of a duſky white, and others of a dull yellow. The belly is of a pale red, in the female greatly diluted, and approaching to white. The whole body is covered with very minute ſcales †. The manner of taking theſe fiſhes is with nets or trammels, as they are called, which are furniſhed with bait to allure the fiſh, and left ſet for ſeveral days, till they are known to enter them.

## *The Gwiniad* §.

THIS fiſh ſeems to be an intermediate ſpecies between the trout and the herring; like the latter, it ſuddenly



* Brit. Zool. † Willough. p. 196.

§ Salmo Lavaretus, Lin. Syſt. Lavaretus Allobrogum, Will.

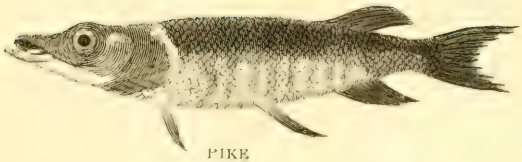
dies when taken out of the water. In length, it is nearly a foot, laterally compreſſed, has two fins upon the back; the firſt about three inches from the ſnout, and ſupported by thirteen rays; the ſecond, which is placed near the tail, is thick, fat, and altogether without rays. It is this ſpurious fin which *Willoughby* aſſumes as the generic mark of all the fiſhes of the trout kind *.

This fiſh, like the charr, is of an alpine nature, and inhabits the lakes of the mountainous parts of *Europe*; ſuch as, *Switzerland*, *Savoy*, *Norway*, *Sweden*, *Lapland*, and *Scotland*: Into the laſt mentioned country, it is ſaid to have been introduced from *France* by the unfortunate *Queen Mary*; a circumſtance rendered probable by the *French* name vangis, given it by the inhabitants in the vicinity of *Lochmaben*. The *Britiſh* name of gwiniad is beſtowed upon it from the whiteneſs of its ſcales †. The gwiniad is a gregarious fiſh; and approaches the ſhores in vaſt ſhoals in ſummer and ſpring, which are the ſeaſons in which it is taken: In ſome of the *German* lakes it is caught in vaſt abundance, and ſalted up for ſale in the neighbouring towns. The fleſh is inſipid, and will not preſerve for any time without ſalt.

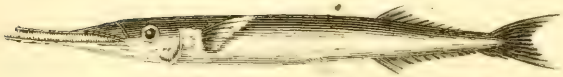
There are twenty-nine different ſpecies of fiſhes belonging to this genus, of which nine ſpecies, with their varieties, are all that is known in *Britain*.

* Vide Ichthyol. p. 183. † Brit. Zool.

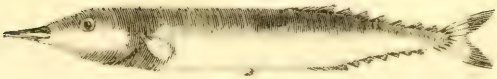
Plate XXVIII.



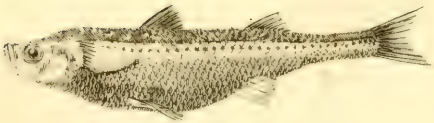
PIKE



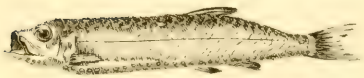
SEA PIKE



SAURY



ATHERINE



ARGENTINE

## SECTION XI.

### GENUS XLVIII.—*The Pike.*

THIS tribe contains in it four ſpecies of *Britiſh* fiſhes; namely, the common pike, the ſea pike, the gar, and the ſaury: They are all diſtinguiſhed, by having only one dorſal fin near the tail; by a long, ſlender body, laterally compreſſed; and by the length of the lower jaw, which projects conſiderably beyond the upper. In general, the ſnout of this family is long, and flattened horizontally; the ſcales are ſmall, bony, and deciduous *.

The moſt remarkable part of the manners of theſe fiſhes is their voracity. Almoſt every kind of animal that is not too large for its ſwallow, is indiſcriminately devoured by the common pike: even thoſe of its own ſpecies are ſacrificed to its gluttony, as often as other food is wanting to ſatiate its ungovernable appetite. Two inſtances are mentioned of its being choaked, by attempting to ſwallow animals too large for its power of deglutition: In the one, the animal expired in endeavouring to devour a pike nearly of its own ſize; the other happened at the canal at *Trentham*, where the pike ſeized the head of a ſwan, as ſhe was feeding under water, and gorged ſo much of it as killed them both †.



* Guan. Hiſt. piſc. gen. 43. † Brit. Zool. gen. 34.

All writers agree in aſcribing uncommon voracity to theſe animals, and mention facts in ſupport of it ſo extraordinary, as would ſeem incredible, were they not in a great meaſure confirmed by daily obſervation. The peculiar ſtructure of the jaws, which are looſely connected together, and have on each ſide an additional bone, like thoſe of the viper, while it favours their voracious inſtincts, proves often their ruin, by prompting them to ſwallow morſels too large, even for that uncommon diſtenſion of which they are capable.

The digeſtive powers of the pike are as remarkable as its voracity: After ſwallowing a fiſh of a ſize but little inferior to its own, thoſe parts that have entered into the ſtomach are diſſolved with amazing rapidity; while thoſe in the mouth and throat, which are yet entire, make a conſtant progreſs downwards, as the proceſs of digeſtion makes way for them. Hence a fiſh, which is too large to be ſwallowed entire, appears for a while with its tail hanging from the mouth of the pike; but ſoon after totally diſappears, and is diſſolved by the ſtomach almoſt as quickly as it enters there *.

From this extraordinary voracity of the pike, aided by ſuch uncommon powers of digeſtion, he is by far the greateſt tyrant of the freſh water. He is ſaid to contend with the otter for his prey, and ſometimes to force it from his mouth. The angler, in drawing a trout, has been known at once to loſe his line and his prize, by the unexpected attack of one of theſe plunderers. When we conſider the numbers and voracity of theſe animals, it may appear ſtrange that any of the inhabitants of the freſh

* Willough. p. 237.

freſh water ſhould eſcape their devaſtations. Young geeſe and ducklings, when they firſt venture into the ponds, are often deſtroyed by them: and all the ſmaller fiſhes ſhew the ſame terror at the appearance of the pike, as the little birds do at the ſight of the hawk or the owl *.

The devaſtations committed by the pike are conſiderably increaſed, by the great longevity of that animal: If the accounts of naturaliſts can be credited, the period of its exiſtence far exceeds that of every other fiſh, not excepting thoſe of the cetaceous kinds. The *Poliſh* naturaliſt *Rzaczynſki* mentions one that reached its ninetieth year †; and *Geſner* gives a print of a brazen ring, that had been affixed to one that was caught near *Hailbrun*, in the year 1497 ‡. On it were inſcribed theſe words in *Greek* characters; *I am the fiſh that was firſt of all put into this lake by the hands of the governor of the univerſe*, Frederic *II. in the 5th of* October 1230. According to this account, the fiſh muſt have been no leſs than two hundred and ſixty-ſeven years of age, a fact too extraordinary to be received on the evidence adduced for it.

The generation of the pike, from its being found in ponds, where none were ever introduced, has been ſuppoſed as extraordinary as its longevity. Nothing, however, ſeems more eaſy than to account for theſe facts, on the well known principles of the generation of fiſhes: If a heron hath devoured their ova, and afterwards excreted them while fiſhing on one of theſe ponds, it is highly probable, that they may be produced from this original, in the ſame way that the ſeeds of plants are known to be diſſeminated

* Britiſh Zoology, Gen. 32. † Hiſt. Nat. Pol. p. 152.
‡ Vide Icones piſcium, p. 316.

diſſeminated *. When the female pike is about to ſpawn, ſhe is ſaid to withdraw as much as poſſible from the common haunts of theſe fiſhes, that ſhe may conceal her brood from the depredations of the reſt, it being a well known fact, that the male of many ſpecies purſues the female when about to depoſit her ova, and on the firſt opportunity devours them.

When the pike is in ſeaſon, its colours are a very brilliant mixture of green, with bright yellow ſpots; the gills are then of a vivid and full red; when out of ſeaſon, all theſe colours decay; the green becomes gray, and the yellow ſpots grow pale. It is only when in ſeaſon that their fleſh is eatable: it is then white, firm and palatable food. *Geſner* relates a moſt extraordinary method of expoſing them to ſale in *England*, which ſeems as little entitled to credit as his account of their longevity. He heard, he alleges, from an eye witneſs, that the animal's breaſt was cut up about two inches, to ſhew its degree of fatneſs, and if no purchaſer offered, the wound was inſtantly ſowed up, and the fiſh again committed to the pond, where, by being rubbed with the glutinous matter on the body of the tench, it was ſoon cured †. In ſome parts of *England* the pike was formerly fed in ſmall perforated boxes of wood, fixed by chains to the banks of the river. Such floating cheſts *Willoughby* declares he has frequently ſeen in a river near *Canterbury*.

The ſeaſon of generation among the pikes is in *March* or *April*, according to the heat of the weather: their fertility is extraordinary; an hundred and forty-eight thouſand

* Willough. ubi ſupra. † Vide Geſner apud Will. p. 238.

thouſand ova being taken from a ſingle fiſh caught in the *Rhine*, which did not weigh above nine pounds *.

This ſpecies of fiſh is common in the lakes, rivers, and ponds, over the whole of the north of *Europe*: It is, however, moſt numerous in *Lapland*, where pikes are ſaid to be taken ſometimes eight feet in length; and their exportation for ſale forms a conſiderable article of commerce. The pike abounds in moſt of the lakes and rivers of *Britain*, and in ſuch numbers as renders the common account of this fiſh being introduced into *England* in the reign of *Henry* VIII. extremely improbable †.

The *American* pike, or *Eſox oſſeus* of *Linnæus*, ſeems far more abundant in the lakes of *Canada* than ours, and forms there a moſt valuable article of food. It grows commonly to the ſize of four or five feet; it is covered all over with bony rhomboidal ſcales, which render it almoſt invulnerable; but is, notwithſtanding, taken by the *Indians* in ſuch quantities, that it forms no inconſiderable portion of their ſuſtenance.

* Leonard. Baltnerus apud Will.

† In the Lincolnſhire fens, numbers are taken in ſemicircular baſkets, open above and below. The manner is, by letting down the baſket from the end of a fen-boat, and as ſoon as the fiſh is found to have entered, it is immediately taken up into the boat.

## *The Gar* *.

THIS fiſh is commonly known by the name of the ſea-needle: it makes its appearance in ſummer, a little before the mackrel, a fiſh it reſembles in taſte as well as in the ſpurious fins near the tail. It is a long ſlender fiſh, flattened a little towards the belly, and quadrangular as it approaches the tail. The head is flat, projecting forward into a very long ſharp ſnout, which is characteriſtic of this ſpecies. The ſides and belly are of a bright ſilvery colour; the back is green, marked along the middle with a dark purple line; the ſides are alſo each diſtinguiſhed by a line running from the gills to the tail. The lower jaw projects a great way beyond the upper, and terminates in a certain ſoft ſubſtance: on both ſides it is provided with teeth, like the common pike; and the upper jaw is moveable as in the crocodile; a circumſtance from which the gar is diſtinguiſhed from all other fiſhes, as well as by the ſuperior richneſs and vivacity of its colours while in the water.

To this genus is commonly referred the ſaury, a fiſh not enumerated by *Linnæus*, but deſcribed by *Rondeletius* as an inhabitant of the *Mediterranean* †. Above and below the tail there are a number of ſpurious fins, reſembling

* Acus vulgaris, Aldrovand. Eſox Belone, Lin. Syſt.

† Piſces, 232.

bling thofe of the mackrel. The jaws are produced like thofe of the garr, but are of equal length, and terminate in a very ſharp point. The upper mandible is ſlightly incurvated, and the length of each is one inch. The eyes are large; the body anguilliform, but towards the tail it grows ſuddenly ſmall, and tapers off into a very ſlender point *. Some years ago, a ſhoal of theſe fiſhes appeared in the *Frith of Forth*, and great numbers were caſt aſhore upon the ſands at *Leith*, where the inhabitants called them *Egyptian* herrings.

* Britiſh Zoology, genus 32.

## Genus XLIX.—*Elops.*

The saurus is the only species belonging to this genus; it is found in *Carolina* and in the *West Indian* seas; and in its external form nearly resembles the pike. The mouth has the same extraordinary gape; while the upper, as well as the lower jaw, is armed with teeth. The ventral and dorsal fins are somewhat larger than those of the common pike, and also placed nearer the head. The anal fin is hard by the tail, which is bifurcated.

The head of the saurus is large, and flattened horizontally; the body is slender, resembling a lance, and covered with large angular scales. The eyes are large, orbicular, and placed at a distance from each other; they are half covered with a nictating membrane. What particularly distinguishes it, is a bony scale at the origin of the caudal fin, both above and below †.

* Elops Saurus, Lin. Syst. Saurus, Sloan. Jam.

† Guan. Hist. piscium.

## Genus L.—*The Argentine* *.

Of this genus there are two ſpecies; the one peculiar to the *American* ſeas, termed by *Linnæus* the *Argentina Carolina*; and the other found in the *European* and ſometimes in the *Britiſh* ſeas. The *European* argentine is moſt frequently ſeen in the *Mediterranean*: *Willoughby*, who examined one at *Rome*, ſays, that the outſide of the air bladder conſiſts of a foliaceous ſilvery ſkin, which was made uſe of in the manufacture of artificial pearl †.

The ſnout of this ſmall fiſh is ſharp and prominent; the body round and tapering, ſeldom exceeding two inches in length. The back and ſides, as far as the lateral lines, are a pale aſh colour, mixed with green: The belly, and parts below theſe lines, are exactly coloured as if covered with ſilver leaf. The mouth is ſmall, without teeth, excepting ſome aſperities reſembling them upon the roof of the mouth, and the tip of the tongue. The eyes are large; the irides ſilvery; and on the forehead is a patch of dark purple. The dorſal fin is placed near the equilibrium of the fiſh, and ſupported with ten ſoft rays. There are two pectoral, two ventral, and an anal fin, near to the tail, which is bifurcated.

* Argentina Sphyræna, Lin. Syſt. Piſciculus Romæ, Argentina dictus, Will. † Willough. 229.

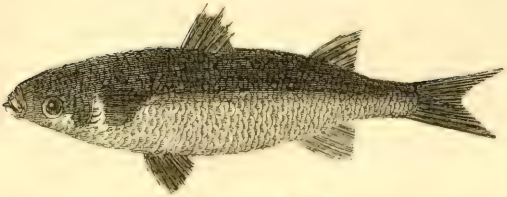
## Genus LI.—*The Atherine* *.

This tribe *Linnæus* has divided into two ſpecies; both diſtinguiſhed by the flatneſs of the upper jaw, by a ſilvery ſtripe along the ſides, and by having ſix branchioſtegous rays. The atherine beſt known on our coaſts, is very common near *Southampton*, where it is called a ſmelt. It is in ſeaſon from *March* to the beginning of *June*, at which period it begins to ſpawn. It never deſerts the place; but may be taken there at every ſeaſon, excepting in hard froſt.

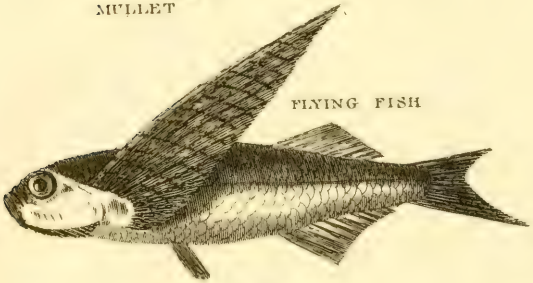
The atherine is from three to four inches in length; and the body is ſemi-tranſparent, except where the ſpine, or the viſcera intercept the rays of light. The ſhape of the body is oblong, and ſlender; the back ſtraight; and the belly a little prominent. The belly is ſilvery; the back variegated with blackiſh coloured ſpots, which become more diſcernable after the ſcales are ſtripped off. The mouth is large; and its aperture, when the jaws are ſhut, ſeems to look upwards. The lips hang down: both jaws, as well as the palate, are beſet with ſmall teeth; and upon the back are two dorſal fins.

* Atherina Heſpetus, Lin. Syſt. Piſciculus Anguella Venetiis dictus, Will.

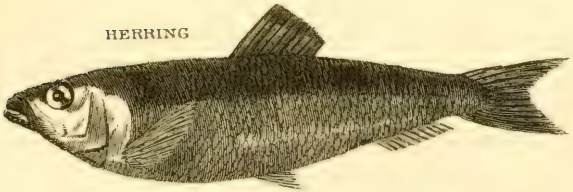
Plate XXIX.



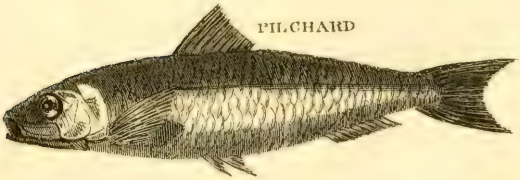
MULLET



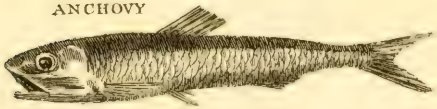
FLYING FISH



HERRING



PILCHARD



ANCHOVY

## Genus LII.—*The Mullet* *.

Rondeletius has described five different kinds of sea-mullets, which do not seem to be any thing more than varieties of the same species: *Linnæus* enumerates only two; the sea-mullet, and the white. The former is taken both off the *English* and *Scotch* coasts. It is covered all over with large scales; the teeth are all placed upon the tongue and palate. The back, which is of a dirty green, is slightly incurvated; while the belly projects more considerably, and is of a pure white. The upper part of the fish is curiously variegated with white and black lines, proceeding in a parallel direction, from the head to the tail: The scales are also arranged in rows parallel to each other; and in the same direction. There are two dorsal fins; the first supported by spinous, and the second by soft rays; the tail is bifurcated †.

The residence of the mullet is the sandy shoals and bays, into which there is an inlet of fresh water: In such situations, they are found all round the shores of *Great Britain*, where they leave the sand all marked with round holes, the traces of their digging, for they keep constantly rooting like hogs among the mud. When surrounded by a net, the whole shoal frequently escapes by leaping over it; one attempting this mode of escape, and succeeding, is immediately followed by all the rest ‡.

The

* Mugil Cephalus, Lin. Syst. Mullet, Willough.

† Willough. p. 274. ‡ Oppiani. Halieut.

The mullets are in great plenty in the *Mediterranean*, and along the ſouthern coaſts of *France*. In a certain lake near *Martegues*, in the ſouth of *France*, there are vaſt ſhoals which enter there during ſpring, the ſeaſon of copulation among theſe fiſhes; after impregnation they return to the ſea, but are intercepted by weres of reeds.

Of the milts and roes of the mullet, the famous *Botargo* of the *Italians* is made up. The materials are taken out entire, and for a few hours covered up with ſalt; afterwards they are preſſed between two boards, dried in the ſun for about a fortnight, when they are fit for uſe. This compoſition is ſaid to brace a weak ſtomach, and to give an exquiſite reliſh to wine, when ate before drinking.

The food of the mullet is mud, or ſea-weed; it never attempts to devour any fiſh. The fleſh of this animal is palatable, though at preſent not a faſhionable diſh; its flavour greatly depends on the ground where it is fed; if among mud, it conſtantly taſtes and ſmells of that kind of food.

According to *Geſner* *, the mullets are the moſt ſalacious of all animals; the male purſuing the female even after ſhe is captured, till drawn aſhore. At *Tarentum*, a male, purſued his female that had been caught with the hook and line, till he received ſeveral ſtrokes with a ſpear, and was at laſt taken and drawn into the boat: By ſuch an ungovernable deſire are theſe animals impelled to fulfil the purpoſe of nature.

At *Athens*, and afterwards at *Rome*, when an unfortunate galant was catched in the company of his miſtreſs, the mullet is ſaid to have been employed by the enraged huſband

* De Piſcibus.

huſband as an inſtrument of a ſhocking puniſhment *. *Juvenal* and *Horace* both allude to it in mentioning the various modes of revenge which rage dictated to the injured ſpouſe †.

——————Necat hic ferro, ſecat ille cruentis
Verberibus; quoſdam mœchos et mugilis intrat.

* *Vide* Cauſabon. in Athen.

† Juven. Sat. x. 316. Hor. Sat. ii. lib. i. 132.

## SECTION XII.

### GENUS LIII.—*The Flying-Fish* *.

THIS genus comprehends two kinds of flying-fish, the volitans and evolans of *Linnæus*; the former is the moſt common kind of the winged inhabitants of the ſea. Hardly any inſtance occurs of either kind being found in the *Britiſh* ſeas †: They are frequent in the *Mediterranean*, and warmer latitudes in the *Atlantic*, where they are continually hunted by the *Dorados* while they continue in their own element; and, as often as they endeavour to eſcape them by aſcending to the air, they become the victims of the gull or the albatroſs; or are by them again forced back into the mouth of their purſuers below, who have ſtill their eyes fixed upon them, and keep pace with their flight. Thus harraſſed by inveterate enemies in both elements, they often fall down upon the decks of ſhips as they paſs, and ſeem to yield themſelves up to man as the more merciful deſtroyer.

In ſize, the flying-fiſh nearly reſembles the mackrel, only of a longer and more ſlender form: if the wings are taken away, it bears a ſtrong ſimilarity to the muſſet: The

* Exocætus Volitans, Lin. Syſt. Mugil Alatus, Rond.

† Vide Pennant's Brit. Zool. gen. 38.

The ſcales are of the ſame large ſize; and the ſame dark green covers the back: the head is depreſſed; the ſnout ſharp; the mouth ſmall, and deſtitute of teeth. There is only one dorſal fin, about a fourth of the fiſh's length from the tail. The two pectoral fins, which are the inſtruments of flight, are almoſt as long as the body, and ſupported by fourteen ſtrong branchy and jointed rays *.

The ancients were acquainted with the flying-fiſh, and gave it the name of ſea-ſwallow †; and all the different writers have taken notice of its faculty of mounting into the air by means of wings.

* Willough. † Hirundo Plinii, l. ix.

## Genus LIV.—*Polynemus.*

This tribe contains three ſpecies, all of which are rare exotics, which never viſit our ſeas. Their bodies are oblong, thick, and covered with ſcales; as is alſo the head, which ſlopes off into an obtuſe ſnout. The jaws are of equal length when open; but when ſhut, the lower is longeſt; both are furniſhed with ſmall, thick and immoveable teeth. The tongue is narrow and ſmooth; but the palate is exaſperated with a number of ſharp tubercles. The eyes are of a middle ſize, placed at a great diſtance from each other, and covered with the common tegument of the head; before them appear the two large apertures of the noſe.

The ſides are compreſſed, and the abdomen carinated; each of the lateral lines are ſmooth, and bend in a direction parallel to the back. There are two dorſal fins; the firſt ſpinous, and placed about the fiſh's equilibrium; and the ſecond, which is larger, behind it. The pectoral fins are long and narrow; the ventral are placed in the abdomen; the tail is large, broad, and bifurcated.

## GENUS LV.—*Mormynis* *.

THE fiſhes of this genus are only two, and both ſtrangers to our ſhores: Their generic characters, an oval body compreſſed at the ſides, and narrow towards the tail: The ſnout protuberant; and the opening of the mouth very ſmall and rough, with a few ſetaceous teeth placed on the extremity of the jaws. The back has a large ſwell, and from it riſes one dorſal fin; the pectoral fins are ſmall, and ſituated near the belly; the anal fin is behind the equilibrium, and that of the tail bifurcated †.

* Le Mormyre, Guan. Mormyrus, Lin. Syſt.

† Guani Hiſt. piſc. gen. 50.

## Genus LVI.—*The Herring* *.

Many of the fiſhes of this genus are well known. Some of them, ſuch as the herring and pilchard, conſtitute a larger portion of the food of the human race, than perhaps any fiſh whatever. The herring fiſhery, which forms ſo conſiderable a branch of commerce to the *Engliſh*, *Dutch*, and other nations of the north of *Europe*, is a modern invention. Thoſe myriads of fiſh which annually teem from the *Artic Seas*, and which are the objects of this fiſhery, are ſuppoſed to have been altogether unknown to the ancients; for there is no word which ſeems to have been appropriated to this moſt numerous ſpecies.

The external characters of the herring are ſo well known, that all deſcription of them would be ſuperfluous. The grand winter reſidence of this fiſh is within the artic circle, where inſect food abounds in a ſtill greater degree than in warm climes. The particular food, however, of theſe fiſhes has not yet been perfectly aſcertained: The inteſtines are filled commonly with a blackiſh mud, apparently too much digeſted to diſcover exactly its nature; it is ſuppoſed to be a cruſtaceous inſect †.

From the *Artic Seas*, the herrings annually migrate along the ſhores of *America*, as far as *Carolina* ‡; along thoſe

* Clupea Harengus, Lin. Syſt. Herring, Will.

† Oniſcus Marinus, Lin. ‡ Cateſby Carolina, II. 33.

thoſe of *Europe*, as far as the north of *France*; and on the eaſt of *Aſia*, they are found on the ſhores of *Kamſchatka*. The great army that annually iſſues from the north, ſeparates into ſeveral diviſions: The firſt makes its appearance off the *Shetland Iſles* in the months of April and May; but theſe are only the harbingers of a far more numerous body, that follows in June. The appearance of theſe ſhoals is always announced by the gulls, gannets, and other rapacious birds, that continually hover above them; but when the great body approaches, about the beginning of Harveſt, its breadth and depth alter the appearance of the ocean, which ſparkles with various colours, like a bed of precious ſtones, by reflecting the rays of the ſun from the ſcales and fins.

When the herrings firſt quit the regions of the *Frozen Sea*, they are divided into different columns, of five or ſix miles in length, by three or four in breadth; and in their progreſs ſouthward, the firſt obſtacle in their way is the *Shetland Iſlands*, by which they are ſeparated into two grand diviſions; the one advancing along the whole *Britiſh* coaſt, filling every bay and creek, till it reaches the *Channel*, after which it gradually thins, till it diſappears. The other great wing makes a ſimilar circuit round the weſt coaſt, till it reaches the north of *Ireland*, where it is again ſubdivided; part entering the *Iriſh Sea*, and part ſcattering along the weſt ſhores of *Ireland*, till it diſappears about the entrance of *St. George's Channel*.

Several ſtationary fiſheries are eſtabliſhed on the weſt of *Scotland* and *Ireland*; but the herrings are by no means uniform in reſorting to the ſame loch or bay annually. They frequent a certain ſpace for a number of years, and then capriciouſly deſert it for perhaps as many more. On the coaſt of *Wales*, and among the *Hebrides*, they

they have at different times occupied and deſerted their ſeveral ſtations, without any apparent cauſe. But although this ſtupenduous gift of the munificent Author of Nature, is at times partially diſtributed, it is never totally withdrawn. The ſame inſtinct invariably operates; and if one part is deprived of its effects, another teems with plenty, and relieves the neceſſity of ſuch as are leſs liberally ſupplied: Thus, thouſands of the poor are annually ſupported, and rendered happy, by that inſtinct which the Almighty hath originally impreſſed upon this uſeful part of his creatures *.

But this appetite for migration, which brings the herring annually to our ſhores, ſerves alſo purpoſes of the greateſt importance in the economy of theſe animals: It leads them to the ſhallow and tepid waters of the temperate zone, to depoſit their ſpawn, where it is matured and vivified with greater certainty than in the midſt of the frozen ocean.

The multiplication of their kind, is, therefore, perhaps the primary purpoſe of nature in the migration of the herring. It is not from a defect of food that they abandon regularly their northern retreats; for it is immediately after leaving theſe, that they are moſt plump: before their return, they are greatly reduced by ſpawning, and are then thin and miſerable. The time of ſpawning is from the beginning of winter till January, when they almoſt totally diſappear from our coaſts, or are taken in ſmall ſtraggling parties by the fiſhermen, for the purpoſe of bait. It is probable, that at the time they abandon our ſeas, they again repair to the north, to reſtore their vigour,

* Brit. Zoology, Gen. 39.

vigour, and, by impregnation, to replace that immenſe waſte, which the exertions of man, and the rapacity of fiſhes, has made of their ſpecies.

The ſpawn, after being diſcharged by the parent fiſhes, continues to float on the waves for a conſiderable part of the Spring. In the beginning of Summer, the young enter upon life, and in June and July are ſeen in vaſt numbers approaching the ſhores. They are then about two inches in length, and moſt probably feed upon inſects, as thouſands have been caught a little after that period with the common trout fly. Along the *Yorkſhire* coaſt, theſe young fiſh are called *file*; upon that of *Scotland*, they obtain the general name of *fry*, which ſeems to be applied indiſcriminately to the young of all fiſh. During winter, it is probable that the young herring retire to the north, along with the old. On their appearance next ſummer, although the ſhoals are made up of fiſh of very different ſizes, it does not appear that they are then diſtinguiſhable from the fiſh of greater age.

The *Dutch*, who have ſet the example to the other nations in almoſt every thing relating to commercial induſtry, firſt commenced the herring fiſhery in 1164 *; and continued in the excluſive poſſeſſion of it for ſeveral centuries. At length the *Engliſh*, rouſed by their gains, and jealous of that naval power of which it was the grand ſource, endeavoured to participate in this lucrative commerce, and for that purpoſe fought many well diſputed battles. The ſuperior induſtry and experience of the *Dutch*, always have, and probably long will, ſecure them the greateſt ſhare of this trade. The moſt conſiderable ſtations of the *Britiſh* fiſheries are off the *Shetland* and *Weſtern*

* Brit. Zool. Gen. 39.

*Weſtern Iſles*, and off the coaſt of *Norfolk*; in all theſe ſtations the *Dutch* ſhips are ever ready to take their ſhare.

One *William Beukelen* of *Biervlet*, near *Sluys*, was the inventor of the uſeful expedient of *pickling* herring; and it is from him the operation has its name, both in the *Engliſh* and *German* languages. This great benefactor of mankind died in 1397; and his memory was held in ſuch veneration by the Emperor *Charles* V. that he paid a viſit to his tomb. The *Dutch*, it is ſaid, are remarkably fond of the herring in its pickled ſtate: A premium is given by the ſtate to the firſt *buſs* that arrives loaded with a cargo; which ſells them for a very high price. The whole inhabitants welcome the arrival with ſhouts of exultation; and the ſame joy ſeems painted on every face, which the *Egyptians* diſplay on the firſt overflowing of the *Nile* *.

## *The Pilchard* †.

THE pilchard, in ſome reſpects, reſembles the herring; it is remarkable for ſimilar migrations, and ſtated returns from the north. As this fiſh is far from being ſo general as the herring, appearing only on the coaſt of *Cornwall* for a ſhort time in the end of Summer, we ſhall give a ſhort deſcription of its external figure.

3 Its

* Idem, ubi ſupra. † Clupea de Artedi. The Pilchard, Will.

Its ordinary ſize does not exceed nine inches; the body is a little thicker in proportion than that of the herring, and the belly leſs ſharp: The ſcales are very large, thin, and rounded; the back is bluiſh; the ſides and belly ſilvery; the head is compreſſed, and the mouth without teeth. The upper angle of each of the gills is marked with a large black ſpot; ſome have four or five ſuch ſpots diſpoſed in a row near the tail; the lower edge of the belly is ſerrated, owing to the row of large clypiform ſcales that runs along it.

The pilchard annually appears in large ſhoals off the *Corniſh* coaſts, from whence it is regularly exported in great quantities into the *Mediterranean*. The fiſhing ſeaſon is from June till the beginning of Winter; a few ſometimes are found hovering about till Chriſtmas. There are ſpies, or *huers*, as they are provincially called, ſtationed on the cliffs that project into the ſea, whoſe buſineſs it is to watch the progreſs of the ſhoals, and to give notice to the boats below of the meaſures they are to take, by means of ſignals previouſly agreed upon.

By an act of *James* I. theſe huers are empowered to go over the grounds of others, without being liable to damages *. By their motions the nets are both ſhooted and drawn; and when they have been ſucceſsful in incloſing part of a ſhoal, an hundred thouſand are ſometimes taken at a ſingle draught. In October 1767, there were at one time incloſed in the Bay of *St. Ives*, ſeven thouſand hogſheads, or two hundred and forty-five millions of fiſh. The average amount of the export of theſe fiſh appears to be 29,795 hhds. annually; which, including the bounty paid by government, and the price of the



* Cap. 23.

oil extracted from them, are ſold for about forty-nine thouſand pounds.

But the great benefit ariſing from the pilchard fiſhery, is the employment it affords to a number of ſeamen, which are thus trained up for the defence of the nation. A variety of hands, too, are employed on ſhore, in the different operations of ſalting, preſſing, waſhing, and cleaning the fiſh, as well as the trades people, who depend upon the conſtruction and ſale of boats, nets, ropes, and caſks *.

## *The Anchovy* †.

This ſpecies is taken in the *Mediterranean*, and exported, pickled, to the different nations of *Europe*. Before ſalting, the head and viſcera are taken away; and in this ſtate they are ate raw, with vinegar and oil. They are ſuppoſed to give wine an excellent reliſh; but probably their chief merit conſiſts in bracing the ſtomach, after being relaxed by exceſſive drinking.

Near a century ago, the anchovy was found at the mouth of the river *Dee* ‡; and ſince that time has hardly ever been deemed an inhabitant of our ſeas. The length of this ſpecies is from four to ſix inches; the body ſlender, but thicker in proportion than that of the herring: The eyes

* Borelaſe's Cornwall.

† Clupea encraſicolus, Lin. Syſt. Anchovy, Willough.

‡ Ray's Letters, 47.

eyes are large; the irides white, with a caſt of yellow; the under jaw much ſhorter than the upper; the teeth ſmall; a row in each jaw, and another on the middle of the tongue. The ſcales are large and deciduous; the back green, and ſemipellucid; the ſides and belly ſilvery and opaque; the edge of the belly ſmooth, and the tail forked.

The genus of herrings, according to *Linnæus*, contains eleven ſpecies; among theſe, however, the pilchard is not enumerated; although, from its hiſtory, we have ſeen that it is one of the moſt common, and perhaps the moſt numerous, fiſh upon our coaſts.

The ſprat is alſo a very common ſpecies belonging to this genus, which *Willoughby* and *Ray* have ſuppoſed to be the fry of the herring. It nearly reſembles the anchovy in ſize and ſhape; but from the time of its appearance on our coaſts, it ſeems to be a diſtinct race from the herring. Theſe fiſh come into the river *Thames* in the beginning of November, and continue there till March; a ſeaſon when the herring have long retired into the North Sea. During the whole of the Winter ſeaſon, they conſtitute a large portion of the food of the citizens of *London*. At *Graveſend* and *Yarmouth*, they are cured like red herring, and ſometimes pickled like anchovies, from which they differ but little in their flavour.

## *The Shad* *.

This is ſuppoſed to be the thriſſa of *Ariſtotle* and *Oppian*, and the alauſa of *Auſonius*; but the deſcriptions which the ancients gave of their ſpecies were ſo vague and general, that we can ſeldom aſcertain the exact ſpecies they had in view. The ſhad, in the ſhape of the body and head, bears a ſtrong reſemblance to the herring; the former, however, is a deeper fiſh, and more compreſſed laterally; it is alſo conſiderably larger, weighing from four to eight pounds. In colour, this ſpecies reſembles the pilchard; the back being of a blackiſh blue, and the ſides ſilvery. On each ſide, near the gills, there is a large black ſpot; and behind it, in the ſame ſtraight line, there is a row of five or ſix others, ſmaller in ſize. The lateral lines are obſcurely diſcerned; the ſcales are large and deciduous, their margins punctuated with ſmall black dots; the belly is carinated, and ſtrongly ſerrated by the edges of forty ſcales, which proceed in a row, from the gills to the anus. The eyes are large, covered as far as the irides with a looſe membrane; the upper jaw is ſomewhat ſhorter than the lower, and exaſperated on the margin with very minute teeth; the other parts of the mouth are ſmooth. The dorſal fin is ſituated near the centre of the fiſh, ſupported by eighteen cartilaginous rays, of which the middle are longeſt; the ventral, pectoral,

* Clupea Aloſa, Lin. Syſt. The Shad, or mother of herring, Will.

toral, and anal fins are ſmall in proportion to the fiſh's ſize; and the laſt is placed very near the tail, which is greatly forked *.

The *Severn* produces the ſhads in higher perfection than any other *Britiſh* river. They appear there in April or May, according to the warmth of the Spring; and after two months they diſappear, and are ſucceeded by other varieties of the ſame fiſh. About *Glouceſter*, the ſhad is eſteemed a great delicacy; it is there caught in nets, and ſold at a price as high as that of ſalmon. It is from thence they are ſent to the *London* market, where they are diſtinguiſhed from the ſhad of the *Thames*, by the *French* name *aloſe*.

It is not aſcertained where the ſhads ſpawn: at the time of their mounting the river, they are in full roe; but none are caught on their return to the ſea, after ſhedding their ſpawn †. The bleak, which are caught in the *Severn* in the months of *July* and *Auguſt*, are erroneouſly ſuppoſed to be the young of this ſpecies. The ſhad is found at certain ſeaſons in the river *Nile*; it is there, as well as in *England*, a fiſh of paſſage ‡; it is alſo ſeen in the *Mediterranean* near *Smyrna*, and on the coaſt of *Egypt*, in the neighbourhood of *Roſetto*.

This ſpecies was reckoned very mean food by the ancients; *Auſonius* characteriſes it as the food of the poor §. Thoſe of the *Thames* agree to his deſcription, being a very inſipid and coarſe fiſh. *Jovius* gives a ſimilar account of this animal as an article of food; but aſſerts that it improves after aſcending the *Tiber* ||. In the

* Willough. page 227. † Belon, 307. ‡ Belonii Itiner, 98.

§ Strideteſque ſocis obſonia plebis Alauſas; Moſella, 128.

|| De Piſcib. Roman.

the *Severn* there is a variety caught near *Glocester*, called the twaite, which is equally diſeſteemed with the *Thames* ſhad. Theſe varieties are diſtinguiſhed by their ſize, the twaite being nearly one half ſmaller than the true ſhad; and has always fewer black ſpots behind the gills *.

* Britiſh Zoology, Gen. 39.

## Section XIII.

### Genus LVII.—*The Carp.*

*Linnæus* makes this genus conſiſt of no leſs than thirty-one different ſpecies; analogous indeed in their external characters, but differing conſiderably in their habits and economy. They are all of an oblong and oval ſhape; the body laterally compreſſed, and covered with large imbricated and deciduous ſcales. The mouth is ſmall, and deſtitute of teeth; hence they have been denominated leather-mouthed fiſhes. They are all diſtinguiſhed by three branchioſtegous rays, and one dorſal fin riſing from the middle of the back, which is convex, and ſomewhat carinated.

The noſtrils are covered with valves, by which they are alternately opened and ſhut; and the greater part of the genus have *cirri*, or beards, round the mouth. Some of theſe fiſh were brought to *England* from the ſouth of *Europe*, and are now naturaliſed in our freſh-water ponds.

## *The Carp* *.

THIS ſpecies was introduced, according to *Fuller*, into *England* in the year 1514, by *Leonard Maſcal* †; but before that time, we read a deſcription of it in the book of *St. Albans*, printed in 1496. It is by means of tranſportation that they have been naturaliſed in moſt countries of *Europe*, as is the caſe in *Sweden*, *England*, and *France*. They have not yet found their way into *Ruſſia*, though *Poliſh Pruſſia*, which is probably their native country, is at no great diſtance: There they abound in all the rivers and lakes, and are taken of ſuch vaſt ſize, that they have become a valuable article of commerce. The merchants purchaſe them from the lakes and rivers belonging to the *Poliſh Nobleſſe*, and tranſport them in well-boats to *Sweden* and *Ruſſia*. In imitation of them, ſome of the *Engliſh* gentry have begun to turn their fiſh-ponds to account, by regularly ſelling their carp ‡.

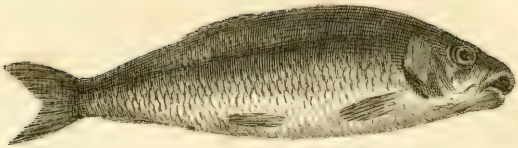
The carp is, perhaps, the moſt remarkable among the ſpinous fiſhes for longevity: An inſtance is recorded of one in the palatinate of *Germany*, that lived an hundred years in the *foſſee* ſurrounding a fort ||. Their ſize in ſome countries is ſaid to correſpond to this extraordinary longevity; ſeveral being taken in the *Lacus Larius*, of two hundred

* Cyprinus Carpio, Lin. Syſt. La Carpe, Belon.

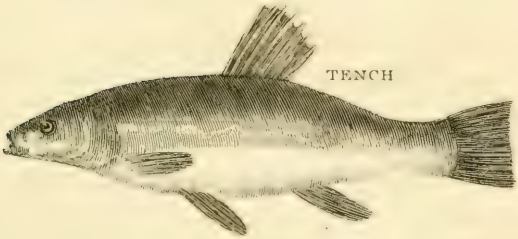
† Britiſh Worthies, Suſſex, 113. ‡ Brit. Zool. gen. 40.

|| Geſner de piſcib. 312.

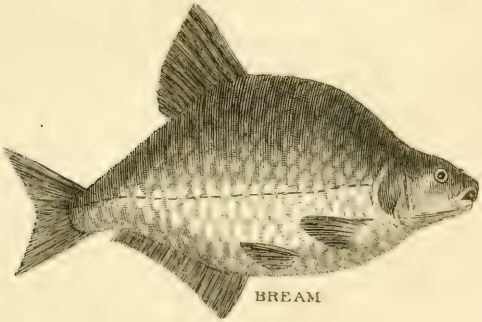
Plate XXX



CARP



TENCH



BREAM

CHUB

hundred pounds weight; while thoſe of the *Dneiſter* ſometimes arrive at the enormous length of five feet *.

Of all the finny tribe, the carp is moſt tenacious of life: when placed in a net wrapped in wet moſs, and hung in damp cellars, it will ſubſiſt for a fortnight †. This fact is ſo well atteſted by experiment, that a method of fattening this fiſh has been adopted, which is founded upon it. The net is from time to time dipped in water, and the fiſh crammed with wheat-bread ſoaked in milk; and by this management, it becomes in a ſhort time not only much fatter, but of a far ſuperior flavour to thoſe fed in the pond ‡.

The fiſhes of this ſpecies being in ſome meaſure domeſticated, their manners and economy have been more narrowly examined than moſt of the other tenants of the water; and the aſcertaining their fecundity has been the reſult of theſe obſervations: The carp is prodigiouſly prolific; its belly being almoſt at all ſeaſons diſtended with a roe, which ſometimes increaſes before parturition, to the full ſize of the fiſh who carries it; and when weighed oppoſite to it, has often been known to preponderate. Upwards of two hundred thouſand ova have been numbered in one roe ‖; and, if we may credit *Ariſtotle*, this immenſe off ſpring is produced five or ſix times every year §. Such is the kind attention beſtowed by nature in preſerving this uſeful claſs of animals, for the ſupport of other portions of her innumerable family!

The carp, like moſt other ſpecies, frequent the ſhallow water at the ſeaſon of ſpawning; when a dozen of males



* Jovius de piſc. Rom. 131.
† Hiſt. Nat. Pol. 142.
‡ Derham's Phyſo. Theol. Ed. 9. p. 7.
‖ Phil. Tranſact. 1767.
§ Hiſt. Animal

are ſeen purſuing one female as ſhe emits her ova; and upon theſe they eject their ſmelts: by which operation naturaliſts ſuppoſe that impregnation is effected. In this uncertain proceſs, however, many of her ova muſt be diſſipated in the water, without coming into contact with the *ſperm* of the male; and hence that fertility is abridged, which would otherwiſe ſoon overſtock the whole waters upon the globe.

Among all domiſticated animals, the purity of their manners is vitiated; and mixed races are produced by an unnatural connection between different ſpecies: This is examplifyed by the horſe and the aſs, by the different ſpecies of dogs, and by many of our domeſtic poultry; the carp and tench, in their confinement in ponds, are alſo ſaid to mingle their ſpawn, and to tranſmit an ambiguous race to poſterity: In ſimilar circumſtances, the carp and bream, are reported to "overſtep the modeſty of Nature," and to violate thoſe laws which ſhe has ſo generally eſtabliſhed between kindred tribes.

The fleſh of this ſpecies is rather inſipid and ſoft, but varies greatly, according to the place where the fiſh is reared, and the nouriſhment with which it is fed: Thoſe in ſtagnated water are ſeldom found ſo well flavoured, as they that are taken from a pure and rapid ſtream. Of the roe of this fiſh a caviare is made for the *Jews*, who abominate this, and every kind of the ſturgeon.

The carp is extremely ſhy in taking a bait, and, for this reaſon, the more common method of taking it in rivers is with the net. Its cunning is diſplayed by the various methods it practiſes to elude this inſtrument of deſtruction: Sometimes it leaps over the net; at others, immerſes itſelf ſo deeply in the mud, that it is drawn over

over it: At the ſpawning ſeaſon, all this artifice ſeems to forſake the animal, and it becomes then ſo ſimple, that it ſuffers itſelf to be tickled, handled, and caught, by any perſon that will attempt it *.

This fiſh, when young, is of a duſky colour, growing yellow as it increaſes in years: The body is of a thick ſhape; the ſcales remarkably large; and when the fiſh is in ſeaſon, of a fine gilded hue. The mouth is ſurrounded by fat, fleſhy lips, of a yellow colour; at the angle of the mouth there is a ſingle beard, of a yellow colour, and above it another, ſhorter, black, and leſs obſervable. The carp has no teeth; their office is ſupplied by two ſmooth triangular bones, above and below, which are placed at the entrance of the throat, and by acting againſt each other, comminute the food before it paſſes downward. The dorſal fin extends far back, almoſt reaching the tail, which is bifurcated. Oppoſite to it is the anal fin, the third ray of which, as well as that of the dorſal, is ſtrong, and armed with ſharp teeth, that point downwards.

## *The Barbel* †.

THIS ſpecies is longer and more tapering in its ſhape than the perch; being from a foot to eighteen inches in length: In the *Nile*, it ſometimes weighs twenty pounds.



* Britiſh Zoology, gen. 40.

† Barbus, Rondel. Cyprinus Barbus, Lin. Syſt.

The colour of the back is a pale olive; the belly is ſilvery, and proceeds without protuberance, nearly in a ſtraight line; ſo that, when touching the bottom, the mouth at the ſame time reaches the ground. The head is ſloping, the ſnout ſomewhat pointed; and on the ſummit of the roſtrum there are two beards; other two ſpring from the ſides of the mouth; a circumſtance from which this fiſh derives its name almoſt in every language. From the middle of the back, which is a little arched, there riſes one dorſal fin with ten rays, of which the firſt is the largeſt. The tail is bifurcated, and between it and the anus there riſes another fin ſupported by ſeven rays *.

The fleſh of the barbel ſeems to have been held in no eſtimation among the ancients: *Auſonius* alone mentions it, and, without any commendation, excepting that it improved by age †. It frequents the ſtill and deep parts of the *Britiſh* rivers, where it lives in ſociety, and roots like a hog among the ſandy banks. The *Danube* is famous for the reſort of this fiſh; it is there found in the caverns of the rocks, and holes under the banks, in numbers that defy all computation. The peaſants take them with their hands, in quantities ſufficient to load a waggon ‡. Thoſe in our rivers are characteriſed by the ſame tameneſs and inſipidity; they are often taken with the hand, by diving: In ſummer they move about in queſt of food; but during autumn and winter, they confine themſelves to the deepeſt holes. The poorer peaſants alone, and that from hard neceſſity, are conſtrained to eat them boiled with a piece of bacon. They are deemed the coarſeſt of all freſh

* Willough. p. 259.

† ——————Tibi contigit uni
Spirantûm ex numero non inlaudata ſenectus.

‡ Albertus.

freſh water fiſh: their roes are even held poiſonous; for they affect thoſe who unwarily eat them, with a nauſea, vomiting, and purging *.

## *The Tench* †.

THE tench is unnoticed in the writings of all the ancients before *Auſonius*; and by him it is mentioned in ſuch terms of diſreſpect, as ſhews the capricioufneſs of taſte;

> Quis non et virides vulgi ſolatia *Tincas*
> Norit?

*Willoughby* mentions the infalubrity of this fiſh, on account of which, it was unanimouſly condemned by the medical people of his time: he denies, however, that it is ungrateful to the taſte; poſterity have been of the ſame opinion, and have gratified their palates with it without feeling any bad effects.

The reſidence of the tench is either in ſtagnated or running water; although it is taken in the *Tiber*, a pretty rapid ſtream, it ſeems to have migrated there from the adjoining lakes ‡. There is ſaid to exiſt a wonderful

* Britiſh Zoology, gen. 40.

† La Tanche Belon. Cyprinus pinna ani radiis 25. Lin. Syſt.

‡ It is now naturaliſed in England, where it has been imported from its native lakes in the ſouth of Europe. We have already noticed with regret, that the ingenuity of man has made ſo little progreſs in the domeſtication of fiſhes; this and the carp being the only ſpecies of near five hundred, that have been brought into that ſtate.

ful friendſhip between this animal and the pike *, a fiſh which, though it devours every other, will not offer violence to the tench, on account of its healing quality. It has hence been called the phyſician of the fiſh; the ſlime of its ſkin being of a healing nature, an inhabitant of the water is no ſooner wounded, than the phyſician is at hand with a powerful ſtyptic:

> Cloſe to his ſcales the kind phyſician glides,
> And ſweats a healing balſam from his ſides †.

The *Jews* practiſing phyſic at *Rome*, are ſaid to apply the half of a tench, after being cut up, to the ſoles of the feet, when their patients are ſeized with violent fevers ‡; we believe, however, that the medical virtues of this fiſh, either while dead or alive, never exiſted but in the imaginations of the ignorant and credulous.

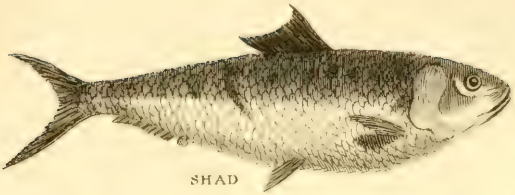
The tench ſpawns in ſpring, and in the beginning of ſummer; it is ſuperior in fertility to the carp, near four hundred thouſand *ova* having been numbered in a ſingle roe. The young fry are remarkably quick in their growth; a circumſtance the more credible, becauſe they devour mucus and every kind of filth with avidity. The moſt proper bait for them is ſmall earth worms: according to the preſent faſhion of eating, they are deemed wholeſome and delicious food.

The tench is thick and ſhort in proportion to its length; the ſcales are very ſmall, and covered with ſlime: The colour of the back is duſky; the dorſal and ventral fins of the ſame colour: The head, ſides, and belly, are of a greeniſh caſt, moſt beautifully mixed with gold, which is

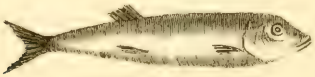
* Salvianus apud Will.

† Diaper's piſcat. Eclogue. ii. ‡ Jovius de piſcib. Romanis.

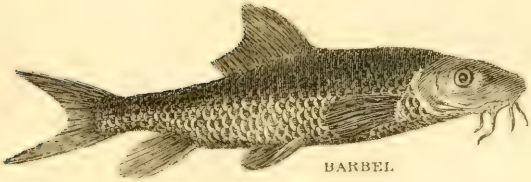
Plate XXXI.



SHAD



WHITE BAIT



BARBEL.

GUDGEON

MINOW

is in its greateſt ſplendor when the fiſh is in its higheſt ſeaſon *.

## *The Gudgeon* †.

THE gudgeon, according to *Willoughby*, is preferred by the *Engliſh* to moſt of the river fiſh; it is taken in gentle ſtreams, and is generally of a ſmall ſize, meaſuring only about ſix inches: In the *Kennet* and *Cole*, they are of ſuperior bulk to thoſe of every other place, and ſometimes weigh half a pound ‡. They are aſſembled by raking the bed of the river, which makes them crowd in ſhoals to the ſpot, expecting food from this diſturbance.

This ſpecies is mentioned by *Ariſtotle* ||, and is therefore probably an inhabitant of the rivers of *Greece*: We know from the accounts of travellers, that it is found in *Syria* §; and thus exhibits a remarkable inſtance of the capacity of fiſhes to accommodate themſelves to different climates. River water muſt always correſpond with the temperature of the country through which it flows; while that of the ſea is of a much more equal heat in different latitudes; and hence we find ſea fiſh travelling into a greater variety of latitudes than thoſe of freſh water.

There

* Britiſh Zoology, gen. 40.

† Gobio Fluviatilis, Rond. Cyprinis pinna ani radiis 2. Lin. Syſt.

‡ Brit. Zoology, ubi ſupra. || Lib. viii. cap. 19.

§ Dr. Ruſſel, p. 75.

There are two ſpecies of the gudgeon, a larger and a ſmaller; the former is an inhabitant of our rivers, the latter of thoſe of *Germany*, where it is called wapper. The *Britiſh* gudgeon upon the back is duſky; the belly of a dirty white: It is diſtinguiſhed by nine or ten large ſpots of a blackiſh colour, upon the lateral lines; others of a ſmaller ſize, being irregularly ſcattered over the back and fins.

At the angle on each ſide of the mouth, there is a ſmall beard of a quarter of an inch; near the eyes are two large apertures of the noſe: Neither jaw is furniſhed with teeth; but at the entrance of the throat there are two triangular bones, that perform the office of grinders, reſembling thoſe of the carp. There is a ſingle dorſal fin, with nine rays; the pectoral have each fourteen, and the ventral eight or nine; the tail is bifurcated.

## *The Bream* *.

THE bream is one of the freſh water fiſh, in no high reputation; its fleſh is ſoft and inſipid. It is of a rhomboidal ſhape, and in the lakes of *Italy* is found ſometimes three feet in length, by two in depth. The back is greatly arched, and the ſides ſtrongly compreſſed: The lateral lines which proceed from the gills, are bent downwards, curvated

* Cyprinus Brama, Lin. Syſt. La Bremme, Belon.

curvated like a bow, and nearer to the belly than the back of the fiſh: above, the bream is a blackiſh green, the ſides and belly white, with a gilded line when the fiſh is in high ſeaſon *.

Stagnated water, or rivers gently gliding along, are the reſidence of this ſpecies; which there feeds upon herbs, mud, and clay. Its ſeaſon of ſpawning is in the month of May; at which period the males are marked upon the head with a number of white tubercles; an incident which *Pliny* takes notice of as befalling the fiſhes of the *Lago di Como* in *Italy* †.

Similar to the bream is the rud, a fiſh frequent in the *Rhine*, the fens of *Holderneſſe*, and in the *Charwell*, near *Oxford*. It is about two pounds weight; and in ſeaſon, almoſt the whole year round, except in the month of April, when it ſpawns. At this ſeaſon, the head of the male is rough with white tubercles, reſembling thoſe of the preceding ſpecies. The rud is reckoned a ſuperior diſh to any of this genus.

The rud ſeems to be an intermediate ſpecies between the carp and the bream; it is broader than the former, and deeper than the latter fiſh. The colour is brown, changing into yellow; the fins are of a reddiſh hue, and the whole body is covered with very large ſcales. The opercula of the gills are, for the moſt part, marked with a blood-coloured ſpot.

In many of the fiſh ponds about *London* and in the ſouth of *England*, there is reared a fiſh called the crucian §; but as it is not mentioned by *Willoughby*, it is probably not a na-



* Willough, p. 248. † Lib. ix. cap. 18.

§ Cyprinus Caraſſius, Lin. Syſt.

tive of our rivers. The colour of this ſpecies is a deep yellow; as an article of food, it is held in little eſtimation. It is very deep and thick, the back much arched, and the dorſal fin ſupported by nineteen rays; the firſt two ſtrong and ſerrated.

## *The Roach* *.

THE roach, like the other fiſh of this genus, frequents the ſtill or ſtagnated waters; it is an excellent pond fiſh, not only thriving well in artificial ſheets of water, but repleniſhing them ſooner than any other ſpecies, with a numerous race of inhabitants. Its offspring are not ſo numerous as thoſe of the carp or tench; this extraordinary fertility muſt therefore be owing to a ſmaller number of the young periſhing before they arrive at their adult ſtate.

The roach is ſmaller than the bream; the ſhape of the body, like that fiſh, is deep and laterally compreſſed, being four inches broad by twelve long. The back is duſky, with a ſhade of green; the belly pale; the ventral and anal fins are a cinnaber colour, the dorſal and tail fin having leſs of the red †. The ſcales are of a ſilver hue, broad and deciduous. The lateral lines are curvated, and run parallel to the ſwell of the belly: The tail is bifurcated.

The

* Cyprinus Rutilus, Lin. Syſt. Leuciſcus, Rondel.

† Willough. p. 262.

The dace * haunts the ſame places as the roach; like it, too, it is a great breeder, very lively, and during ſummer, fond of gamboling on the ſurface of the water. Its colour is a mixture of brown and yellow; the ſcales are ſmaller than thoſe of the roach; the length of this fiſh is ſeldom above ten inches.

The graining is a fiſh ſo nearly reſembling the dace, that perhaps it may be conſidered merely as a variety: The uſual ſize is from ſix to eight inches; it is caught in the *Merſey* near *Warrington*.

## *The Gold-fiſh* †.

This ſpecies was firſt introduced into *England* from *China*, in 1691; and that ſpecimen having been deſtroyed, they were again imported about thirty years ago in a conſiderable quantity. From that time they have multiplied greatly in the neighbourhood of *London*, and from thence have been gradually diſperſed over the reſt of the kingdom, where they now breed as freely in the open water as the carp.

The moſt beautiful ſpecies of theſe fiſhes are kept in *China* for the amuſement of people of rank. They are confined in ſmall porcelain veſſels, and placed in the courts to decorate the entrances of the houſes belonging



* Cyprinus leuciſcus, Lin. Syſt.

† Cyprinus Auratus, Lin. Syſt. Kin-yu, Du Halde Hiſt. China.

to the nobility. The beauty of their colours and lively motions, give great entertainment, especially to the ladies, whose pleasures are extremely circumscribed, from the cruel policy of that people *.

In shape, these fishes bear a great resemblance to the carp; and in their native lakes they are perhaps not greatly inferior in size; for they are said to equal our largest herring †. Beautiful coloured drawings of them have been executed by *Edwards* ‡; their prevailing colour is gold, of a most amazing splendour; there are varieties marked with fine blue, brown, and bright silver; the most beautiful are said to be taken in a small lake in the province of *Che-Kyang* ||.

## *The Chub* ¶.

THERE are five species, or rather varieties, of this fish enumerated by *Willoughby*, after the ancient naturalists: That fish known in the *English* rivers does not grow to a large size, seldom exceeding five pounds. The chub is a very coarse fish, and full of bones; it frequents the deep holes of rivers, and, during summer, commonly lies on the surface, beneath the shade of a tree or bush. It is a very timid fish, sinking to the bottom on the smallest alarm, even at the passing of a shadow, but soon resumes



* Brit. Zoology, gen. 40.
† Vide Du Halde, p. 316.
‡ P. 209.
|| Brit. Zool. ubi supra.
¶ Cyprinus Cephalus, Lin. Syst. Cephalus Fluviatilis, Rondel.

its ſituation. It riſes to a common trout fly, and feeds on worms, caterpillars, graſhoppers, and other coleopterous inſects, that happen to fall into the water *.

The body is longer than that of the carp; the head flattened; the back of a duſky green; the ſides and belly ſilvery, with a ſhade of a gold colour, if the fiſh be old and in high ſeaſon. The ſcales are remarkably large and angular, like thoſe of the carp; the mouth is of a moderate ſize, round when the jaws are opened, and wholly deſtitute of teeth. The number and diſpoſition of the fins reſemble thoſe of the other fiſh belonging to this genus; the tail is forked.

## *The Bleak* †.

THIS ſpecies is frequent in the *Engliſh* ſtreams, as well as thoſe of the *Continent*. According to *Auſonius*, the taking of theſe fiſhes was anciently the amuſement of children, as that of the following ſpecies is at preſent ‡. The fleſh is ſoft, and deſtitute of fat, making no very commendable morſel.

They are at ſome ſeaſons apparently ſeized with a diſorder, which ſeems to occaſion them great agony: They are then ſeen tumbling about near the ſurface of the water, and are incapable of ſwimming far from the place; but

* Brit. Zool. Species 175.

† Cyprinus Alburnus, Lin. Syſt. Alburnus, Rondel.

‡ Alburnos prædam puerilibus hamis.

but in about two hours they recover and diſappear. When thus affected, the fiſhermen on the *Thames* call them mad bleaks. *Pennant* imagines, that they are then troubled with a ſpecies of hair worm, which *Ariſtotle* obſerved to infeſt ſome other kinds of fiſh *.

It is of the ſilvery ſcales of this ſpecies of fiſh, that artificial pearls are made; an art which owes its origin to the *French*, and is by them carried on to ſuch an extent, that one artiſt in *Paris* uſed thirty hampers of fiſh in this manufacture, during the ſpace of a ſingle winter. The ſcales are beat down into a fine powder, then diluted with water, and introduced into a thin glaſs bubble, which is afterwards filled with wax.

The minnow is a beautiful ſmall fiſh, about three inches in length, and ſcarcely half the ſize of the bleak; it frequents moſt of our pure gravelly ſtreams, and is always gregarious. It has no teeth; and the ſcales are ſo ſmall, that they are almoſt inviſible. The back is a dark olive colour; each ſide beautifully adorned with a lateral line of bright gold. The colour of the ſides and belly varies; in ſome it is white, and in others yellow; in ſome it is of a rich crimſon. Taking the minnow is one of the favourite, and perhaps moſt innocent amuſements of children. This firſt eſſay at angling is performed with a bended pin, baited with a ſmall earth worm.

During the month of June, there appears in the *Thames*, near *Blackwall* and *Greenwich*, a fiſh evidently of this genus, called the white bait. No naturaliſt has yet determined to what particular fiſh it belongs, though all are agreed, that it is the young of ſome ſpecies that reſorts there. Some have aſcribed its origin to the ſhad; others to the ſprat, the ſmelt, and the bleak. Theſe fiſh, however,

* Brit. Zool. Species 176.

however, are all found in other ſtreams, while the white bait is peculiar to the river *Thames*.

The white bait has a greater ſimilarity to the bleak than any other fiſh; the number and diſpoſition of the fins are the ſame; and the body is compreſſed on the ſides, in the ſame manner. The uſual length of this ſmall ſpecies is two inches; the dorſal fin is placed before the equilibrium; ſo that, when ſuſpended by it, the tail ſinks down. The tail is forked, and black on the tips. Theſe ſmall fry are uſually caught for the purpoſe of bait for other fiſh; when fried with flour, they are reckoned a delicious viand by the lower order of epicures, who frequent the taverns contiguous to the places where they are taken *.

* Brit. Zool. Species 176.

# NATURAL HISTORY

OF

# INSECTS.

## CHAPTER I. OF INSECTS IN GENERAL.

SECT. I.—*General idea of the number and variety of Inſects: Inducements to the ſtudy of Entymology. Hiſtory of this Science.*

WE are now to enter upon that department of Natural Hiſtory which treats of Inſects; by the ſtudy of which, we are conducted into a province the moſt extenſive, and by far the moſt populous, of the whole empire of nature. The reſidence of quadrupeds, as we have ſeen, is confined to the land; that of fiſhes to the water; while birds are enabled to riſe from the ſurface of theſe elements into the aerial regions. Nature, however, has aſſigned a ſtill more extenſive range to thoſe animals upon whoſe hiſtory we are now to enter. They are found to pervade every part of her dominions, in num-

bers that defy all computation: For in nothing does the immenſity of her works more ſtrikingly appear, than in the infinite number and variety of thoſe her ſmaller productions.

Entymology, therefore, of all the ſciences, preſents the wideſt field for inveſtigation. The number of experiments and obſervations neceſſary to furniſh a complete hiſtory of ſo many ſmall animals, is not only great; but the difficulty of making them is alſo immenſe. The number of ideas with which a ſkilful botaniſt muſt load his memory, before he can acquire an accurate knowledge of above two thouſand plants, is no doubt great: his taſk, however, bears no proportion to that of the entymologiſt; for, amidſt ſo many plants, there is perhaps hardly one that does not furniſh nouriſhment and an habitation to ſeveral inſects; while many, ſuch as the oak, afford a retreat for ſome hundreds of different ſpecies *. Theſe plants, however, are far from being the only abode of inſects; vaſt numbers reſide upon the larger animals, whom they continually ſuck; many live upon and devour others of their own order. Infinite numbers ſpend a part of their lives in the water; others remain there entirely: The earth ſwarms with multitudes; and the air teems with others, too ſmall for the human eye to obſerve, and too numerous for the imagination to conceive!

While the numbers of this claſs of the animal kingdom thus exceed all our powers of conception, its varieties are alſo multiplied to a degree that renders a complete diſcrimination of them equally impoſſible. The different ſpecies

* Mem. pour ſervir a l'Hiſt. des Inſects, par Reamure, Tome prim. page 2.

ſpecies of inſects are not only numerous, but each has its own diſtinct hiſtory, and exhibits manners, appetites, and modes of propagation peculiarly its own. In the larger ranks of exiſtence, two animals that nearly reſemble each other in form, will be found to have a ſimilar hiſtory; but here, inſects almoſt entirely alike will be found very diſſimilar in their habits, and in the different changes which they undergo during their ſhort lives *. To give a full enumeration of all the animals contained in this province of nature, would prove a taſk extremely arduous; one which no naturaliſt has ever pretended to accompliſh. To furniſh a diſtinct and complete hiſtory of each, is an undertaking for which the human powers ſeem altogether unequal; their imperfection, at leaſt, forbids us to hope that it will ever be effected.

But although a complete hiſtory of the operations of nature in this large and populous part of her empire cannot be expected; yet, ſuch a general picture may be given, as ſhall demonſtrate the exiſtence of that great vivifying principle by which ſhe is animated, and by which ſhe is enabled continually to pour forth into exiſtence ſuch immenſe numbers of organized beings. A hiſtory of ſuch inſects as moſt frequently occur, and whoſe manners are beſt known, will preſent to us a pleaſing view of that protection which providence affords even to the ſmalleſt of its creatures;—of the means it employs for perpetuating them;—and of that great arrangement of nature, by which one ſet of living beings find ſubſiſtence, by devouring another, and by which life is continued through every part of the creation, without a pauſe.



* Goldſmith's Natural Hiſtory, Vol. VII. p. 239.

Natural hiſtory claims it as its prerogative to demonſtrate the exiſtence and the perfections of that Creative Power which produced, and which governs the univerſe: It is the hiſtory of the works of God, and naturally leads every intelligent mind to their Author; for there are no proofs of his exiſtence more level to the apprehenſion of all, than thoſe which it offers to the underſtanding. No rational man can ever bluſh for having placed among his occupations a ſtudy which has for its object the works of the Supreme Being which leads him to the contemplation of their author. All thoſe naturaliſts who have deſcribed the different parts of the animal kingdom, have willingly confeſſed them to be productions of infinite power and wiſdom; and ſeem to regret, that the experiments and obſervations relating to their hiſtory are not more numerous; becauſe, in proportion as they are extended, the proofs of a Creative Power are multiplied.

The manner, however, in which entymology has too frequently been ſtudied, and the extremes into which men, according to their different capacities and taſtes, have fallen, have brought that obloquy and deriſion againſt the ſcience, which a proper degree of diſcernment would have directed againſt the foibles of thoſe who ſtudied it. While the ſyſtems of ſome naturaliſts contain only a dry repetition of ſhades, colours, and ſhapes of different inſects, without entering into the more intereſting and animated deſcription of their manners, thoſe of others, as injudiciouſly, aſcribe to them functions, and a degree of intelligence of which they are incapable. By the former, the imagination is fatigued and diſguſted with a conſtant repetition of the ſame images: By the romantic air of the latter, the mind is led into diſtruſt with regard to the truth of the whole narrative, and to doubt of thoſe facts which

which are well eſtabliſhed and certain. Hence the ſtudy of entymology has been deemed by many, an occupation the moſt uſeleſs and frivolous in which the human mind can be engaged: Hence too, from a fear of proſtituting their talents, many have been deterred from contemplating the wonders diſplayed by nature, in a kingdom of animals the moſt numerous, diverſified, and ſplendidly adorned, of any on the face of the globe; and thus have deprived themſelves of views of the power and munificence of the Author of Nature, the moſt ſtriking and intereſting that can be preſented to the mind of man.

To thoſe who can derive no pleaſure from the purſuits and ſtudies of a liberal mind, and who feel no ſatisfaction in any employment that is not attended with immediate profit, the reſearches of the entymologiſt cannot ſeem altogether uſeleſs. Had the operations of the ſilk worm never been examined, how could men have availed themſelves of the labour of an inſect that adminiſters ſo profuſely to our luxuries and our wants? It was not to the unobſerving that it firſt occurred, that the produce of that animal's labour might be converted into a conſiderable article of commerce, and might give riſe to many arts, and afford ſubſiſtence to thouſands of manufacturers. In the ſame manner, wax and honey enter into the articles of commerce, and add to our enjoyments. It cannot, therefore, be denied, that they were profitably employed, who firſt obſerved the induſtry of the bee; who brought that animal from its native woods, introduced it into our gardens, and, by domeſticating it there, have rendered it ſubſervient to our enjoyments.

The *Chineſe*, whoſe progreſs in many of the arts is ſuperior to that of any other nation, avail themſelves of the labours of certain inſects, in procuring a rich dye, and

and an elegant varniſh, which is provided by a certain ſpecies of winged ant. The celebrated purple dye of the ancients was the produce of a ſmall ſpecies of ſhell-fiſh; and we are told by *Pliny*, that the diſcovery of its virtue was occaſioned by a dog, who, in eating the fiſh, had dyed his ears with that beautiful colour *. It ſeems probable that the ancients were capable of communicating to their ſtuffs many beautiful ſhades of ſcarlet with which we are unacquainted; and it is not unlikely that we have alſo ſome rich tints of that colour which they wanted. It is certain that our fineſt red colours are furniſhed by inſects with which they were unacquainted. *Cochineal*, the extenſive and profitable uſes of which have been long known, is now univerſally allowed to be an inſect, which is propagated with care, and in vaſt numbers, in the kingdom of *Mexico*. The *kermes*, or grain of ſcarlet, which was formerly imagined to be one of the galles or excreſcences that are ſeen on ſhrubs, is now underſtood to be an inſect, which attaches itſelf in that form to a ſpecies of the oak †.

The medical uſes of certain inſects are far from being inconſiderable; and to theſe purpoſes they have long been applied, perhaps more frequently, and with better effect, than at preſent ‡. The valuable purpoſes to which the can-

* Reamure, Tome I. p. 5.

† The quercus coccifera of Linnæus. The red dye collected from this tree is produced in Africa; it is not ſo bright, but more permanent than cochineal. The *coccus quercus* forms galles upon the common oak, which are brought from the Levant, and are univerſally uſed in dyeing over Europe. We have this plant in Britain, and alſo that of the coccus poloniecus: The inſect which inhabits theſe plants might in all probability thrive, if imported into this iſland.

‡ Hiſt. Medic. des Anim. par Vanden Boſche, Liv. iv.

cantharides has been made ſubſervient, will alone vindicate the utility of thoſe reſearches which have been made concerning this part of the animal kingdom. There are other uſes to which inſects have been applied, and that from the moſt remote antiquity, which appear of a ſtill more ſingular nature. Before the time of *Theophraſtus* and of *Pliny*, certain kinds of them were employed in ripening the figs throughout the iſlands of the *Archipelago* *; and it appears that the ſame practice ſtill ſubſiſts among the preſent inhabitants of theſe iſlands †. There are two kinds of figs cultivated around the *Mediterranean*; the wild, and the domeſtic. The former produces fruit ſeveral times in the year; and in it are produced certain worms, which are afterwards transformed into ſmall flies. It is by the aſſiſtance of theſe little animals that the domeſtic fig is brought to maturity, which would otherwiſe drop from the tree in an unripe ſtate. During the months of June and July, the peaſants of theſe delightful climes are buſily employed collecting ſuch of the wild figs as abound moſt with theſe inſects, and in placing them near the cultivated fig, that they may co-operate with the climate in bringing it to maturity. Similar purpoſes might probably be ſerved by a judicious application of inſects to fruit in more northerly climates, were we acquainted with the proper ſpecies. Thoſe prunes, pears, and apples which are firſt ripe, are commonly found penetrated by worms.

But there are other inducements to the ſtudy of inſects, of a nature totally different from thoſe already mentioned; inducements, founded not on any hope of advantage to be derived from theſe animals, but of alleviating

* Vide Plinii Hiſt. Nat. † Voyages de M. de Tourneforte.

leviating or preventing the numerous miſchiefs they occaſion. Infinite ſwarms of theſe animals annually deſolate whole provinces; others attack our gardens and cultivated grounds, where they commit endleſs devaſtations upon the corn, vegetables, and fruit trees. Nor are their depredations confined to the fields; they enter the habitations of man, and by deſtroying the timber, gradually reduce them to ruins. They deſtroy his furniture and clothing; ſome of them ſpare not even his perſon, tormenting it long before the period which nature has deſtined it to become their legitimate prey. Here, then, is a wide field laid open for ſtudy; and the perſon who could inform mankind how to remove or alleviate theſe miſchiefs, would deſerve better of his ſpecies than if he had diſcovered the longitude.

Thus, by a cloſer examination of the deſtructive powers of inſects, we ſhall have melancholy proofs of their importance in the ſyſtem of nature, and be perſuaded, that however deſpicable they may appear, there is no claſs of animals whoſe hiſtory more nearly concerns us, and which better deſerves the attention of the naturaliſt.

There are four different ſpecies of the locuſt which are remarkably deſtructive. Almoſt every year, whole provinces, the moſt fertile in *Aſia* and *Africa*, are laid waſte by their depredation. In *Tunis* and *Algiers*, ſwarms of the *gryllus migratorius* appear ſo numerous, that they darken the face of the ſky, like a thick cloud. Theſe pernicious animals are waſted there by the ſoutherly winds in the month of April: In May they take their departure for the interior parts of the country, to propagate their young; theſe make their appearance in their *larva* ſtate, during the month of June, when they commit vaſt depredations. The firſt columns, which pervade

the country like an army, deſtroy every green ſhrub and pile of graſs; and their devaſtation has not ceaſed, when they are ſucceeded by other ſwarms, that preſs upon their rear, devouring the tender branches and ſtalks of plants, which their forerunners had left. This dreadful viſitation, which the language of Scripture has juſtly deſcribed as a plague, does not terminate till the inſects have paſſed into their winged ſtate, when they fly off, leaving the whole ſurface of the earth naked and brown, as if ſcorched by fire.

Little inferior to the locuſt in its deſtructive powers is the *Phalæna Graminis* of *Linnæus*, which deſtroys the meadows in *Sweden*: There the peaſants are employed in cutting deep ditches in the ſurface to ſtop the progreſs of the larvæ as they paſs along: If the ſwarm be ſmall, this device has the deſired effect; but the numbers of theſe animals are often ſo great, that they fill up the trenches, and paſs along over the dead bodies that are buried in them. The formica ſacchilifera is a native of the *Weſt Indies*, where it pervades the plantations of the ſugar-cane, entering the plants, and deſtroying them when they are tender: After long experience of its depredations, the inhabitants have never been able to invent a method of deſtroying this pernicious animal. In our own country, the turnip fly, the butterfly, and the gooſeberry worm, have long committed depredations in the fields and gardens, which no invention has hitherto been able to prevent: Againſt the laſt of theſe animals, indeed, the watering the buſhes with an infuſion of tobacco, has been found efficacious, by killing the greater number in their larva ſtate.

Another object highly worthy the attention of the entymologiſt, is the means of preſerving corn from the invaſion of inſects, after it is collected into granaries. Our ſubſiſtence in almoſt every ſtage of its progreſs, is conſtantly expoſed to the intruſions of theſe enemies of human induſtry. Flour, biſcuit, and almoſt every kind of proviſion, even after it is barrelled up for exportation, is liable to be devoured, or rendered uſeleſs, by the depredations of the moſt hideous animals. The patriotiſm of ſtateſmen, and their zeal for the good of mankind, could not receive a nobler or more uſeful direction than in holding out rewards to ſuch as might diſcover the moſt effectual means of preventing the ravages of thoſe animals, who, by the moſt deſtructive activity, are continually converting large ſtores of proviſions into ſo many maſſes of corruption.

May it not be hoped, that by a careful ſtudy of the nature of inſects, ſome means may be diſcovered to prevent them from penetrating into the joiſts of buildings, and thereby reducing them into duſt, and effecting the deſtruction of the moſt coſtly edifices. How often do we find wooden furniture deſtroyed by inſects, which might have anſwered the purpoſes for which it was intended for ages, had it been preſerved from the deſtructive attacks of theſe animals? How many accidents are probably occaſioned at ſea by thoſe formidable worms, whoſe heads are armed with hard ſhells, and who are thereby enabled to gnaw through the thickeſt veſſels, and make perforations under the water? The alarms they have frequently occaſioned in *Holland*, by introducing themſelves and multiplying among thoſe wooden ſtakes which ſupport their dikes, are univerſally known. The naturaliſt who ſhould diſcover

diſcover a mode of preventing ſuch devaſtations, would certainly deſerve well of his country and of mankind, by communicating information that tended ſo directly to the public good.

The tar extracted from coal by that ingenious nobleman the *Earl of Dundonald*, when better known, will probably be found an efficacious remedy againſt the coroſions of wood by inſects in all caſes where it can be applied. It not only penetrates ſo deeply into wood that it cannot be waſhed away; but is of ſo acrid a ſubſtance, as muſt inevitably deſtroy worms. The intolerable effluvia which it emits, will, however, prevent its application in the caſe of houſehold furniture.

The pernicious genus of phalæna, which contains all the different ſpecies of moths, makes ſtill nearer approaches to man in the hoſtilities which it commits. No perſon is ignorant of the deſtructive quality of theſe inſects to woollen cloth, and all kinds of fur and wearing apparel. The aſtoniſhing inſtinct of theſe animals, in providing a proper receptacle for their eggs, and food for their young, have not withdrawn that indefatigable entymologiſt *Reaumure*, from deviſing efficacious methods of preventing their depredations upon woollen ſtuffs and furs *.

Of ſuch vaſt extent are the miſchiefs occaſioned by the inſect tribe upon the various objects of human induſtry, and the neceſſaries of life; all theſe, however, would in a manner diſappear, were we to reflect upon their dangerous effects upon the human body, and the huſbandman's attention would be withdrawn from the depredations committed on his fields, did he imagine that thou-

* Vide Mem. de l'Acad. 1728.

fands of the fame noxious race were continually entering into his lungs by breathing. During the whole of the fummer months, the atmofphere teems with myriads of fmall animals, and particularly in the months of July and Auguft: It is then that the exceffive numbers that are conveyed into the ftomach and lungs, probably generate thofe epidemic diforders for which that feafon of the year is fo remarkable. If we pafs from thofe dangers which are lefs vifible, to others more apparent, with which infects threaten the human race, we fhall ftill find room to commiferate the inhabitants of many parts of the globe. What an uncomfortable life muft the poor *Laplander* lead, fince, at certain feafons of the year, the number of infects is fo great, that a candle is no fooner lighted than the flame is extinguifhed by the multitudes that flock to it; where, after millions are deftroyed, famifhed millions fucceed, and renew the unceafing combat. Even in *Britain*, which is happily free from thefe unrelenting invaders, much inconvenience is often felt from the bug, the hornet, the wafp, and the bee *.

To counteract thefe inveterate enemies of man, and to relieve him from the mifchiefs they occafion, ought always to be one aim of the entymologift: and no perfon will deny, that whoever, by the ftudy of infects, has found the means of availing himfelf of the labours of fuch as are ufeful, or preventing the noxious from doing harm, hath rendered an eflential fervice to mankind.

After all, however, it will readily be allowed, that in purfuing the hiftory of infects, the number of ufeful obfervations

* The firft of thefe animals has been found to be effectually deftroyed by the fmoak of peat.

obſervations with which it preſents the reader, bear but a ſmall proportion to thoſe whoſe object is merely to gratify curioſity. But in what ſcience is there nothing to be found but what is immediately uſeful? and are not objects of curioſity often nearly allied to thoſe of utility? Is it not while we amuſe ourſelves with the former, that we are moſt frequently led to the diſcovery of the latter? To theſe circumſtances, we may add another for the encouragement of thoſe who undertake to write upon this ſubject; that works the moſt uſeful are not always the moſt favourably received: The number of thoſe who read for amuſement, is at leaſt equal to thoſe who read for inſtruction. A taſte for the marvellous, in a greater or leſs degree, is univerſal among men: It is this which leads them to prefer romances, novels, *Perſian* and *Arabian* tales, to the incidents of real hiſtory. The generation, the metamorphoſes of inſects, their means of rearing their young, and of procuring food, preſent to the reader wonders, perhaps not inferior to thoſe that are fabricated by the moſt licentious imagination; with this difference, that the latter are true. The entymologiſt therefore, has himſelf rather than his ſubject to blame, if his works are not read by the public with avidity.

## SECT. II.—*The Literary Hiſtory of Entymology.*

THE claſs of inſects, although by far the moſt numerous in the animal kingdom, the moſt remarkable for its effects on the objects of human induſtry, and perhaps the moſt important in the economy of nature, was long before it attracted any conſiderable degree of attention from men of learning. Hardly any attention was beſtowed on entymology by any of the writers of antiquity. *Ariſtotle*, that father of naturaliſts, has allotted but a ſmall portion of his works to the hiſtory of inſects; nor does it appear that he has been always ſufficiently attentive to the authorities upon which he inſerts the different facts he relates, or to the order in which they are arranged. It is known, that *Alexander* his pupil furniſhed him with conſiderable ſums to be employed in the various reſearches neceſſary for the compilation of his hiſtory of animals; and it is not improbable, that many perſons were engaged in different parts to procure him the different ſpecies, and to furniſh him with ſuch obſervations on their hiſtory as fell not within the reach of his own knowledge. From ſeveral of the facts which he has related, we are led to ſuſpect, that theſe men were not altogether qualified for the taſk in which they were employed. The arrangement followed by the *Grecian* naturaliſt ſeems as defective as the authorities upon which his

his obſervations are founded. It conſiſts of a long and tedious enumeration of animals, whoſe appearance and hiſtory correſpond in certain particulars; followed by another of thoſe which differ from the former. Enumerations of this kind are ſeldom complete, and long before they can become ſo, muſt prove a burden too great for the memory to retain *. The hiſtories of *Pliny* and *Ælian* are formed upon the ſame plan, and are liable to ſimilar defects: They conſiſt of a number of obſervations ill arranged, and inſufficiently authenticated.

During that long ſucceſſion of ages, which was only diſtinguiſhed by ignorance and barbariſm, entymology ſhared the ſame fate with every other ſcience: It was condemned to oblivion. After a taſte for literature had begun to revive, the hiſtory of inſects again attracted the notice of the curious; unhappily, however, for the growth of ſcience, men were then devoted to the ſtudy of the ancients with a blind admiration: It was from their writings that they imagined the moderns were to derive a complete knowledge of all the ſecrets of nature; and *Ariſtotle* was principally conſulted for the hiſtory of animals. Had *Aldrovandus*, *Geſner*, and *Mouffet*, beſtowed the ſame attention in ſtudying the works of nature that they employed upon the writings of that naturaliſt, they would have made a much greater progreſs in real knowledge: But they unfortunately obſerved nature only to obſerve there what they had read from *Ariſtotle*. This exceſſive predilection for antiquity ought not indeed ſo much to be imputed to theſe authors as to the age in which they lived; a period when every thing was deemed

* Vide Hiſt. animal. paſſim.

deemed contemptible, that was not found in the writings of the ancients.

The attempts of thefe early writers gave birth to the refearches of others, who were gradually more bold and fuccefsful, in proportion as their reverence for antiquity was diminifhed. In 1668, about twelve years after *Mouffet* publifhed his *Theatrum Infectorum*, the experiments and obfervations of the celebrated *Redi* made their appearance in *Italy*. His inveftigations were principally directed to the manner of the generation of infects, with a view to overthrow that abfurd and erroneous doctrine eftablifhed by the ancients, of their arifing fortuitoufly from different bodies in a ftate of putrefaction. Nothing can more fully demonftrate the ftrength of prejudice than thofe elaborate treatifes which *Malphigi*, *Swammerdam*, and *Redi* were obliged to compofe, in order to combat the notion of the fpontaneous generation of thefe animals; an opinion which at prefent feems as ridiculous and unphilofophical as it is untrue. Notwithftanding all their efforts to prove that the fmaller animals are produced in the fame manner with the larger, and that the organization of the body of a mite requires the fame apparatus of limbs, and the fame delicate ftructure as that of an elephant, attempts were ftill made to revive the ancient error by *Kirker*, *Bonarie*, and others *. And what is moft mortifying to human reafon, the fame *Redi*, the declared enemy of prejudices, and the man of all others who knows beft how to combat them, has, upon this very fubject, fallen into a fimilar error. In order to produce thofe infects which are found

* Vide Motti di dubitar intorno la generazione de viventi, fecondo le opinione de moderni.

found upon the ſmall excreſcences of plants and trees, he found himſelf obliged to confer a vivifying power, a kind of ſoul upon thoſe vegetables where they were found, and has laid aſide the ordinary mode of generation, which in other inſtances he had laboured to eſtabliſh.

*Swammerdam* was the contemporary of *Rhedi*; and, like him, he poſſeſſed the courage to examine nature, and to think for himſelf. This naturaliſt made many anatomical obſervations upon inſects, which after his death were publiſhed at *Leyden* *, and laid the foundation of future improvements in entymology. About the ſame period, *Madame Marianne*, a *Dutch* lady, contributed largely to bring the hiſtory of inſects into requeſt, by the beauty of her paintings and drawings. After having executed elegant drawings of ſeveral of the inſects of *Europe*, from a ſingular avidity for theſe ſtudies, ſhe was prompted to croſs the *Atlantic*, and give paintings of thoſe in *America*. Having reſided for ſeveral years in *Surinam* in *South America*, ſhe returned to *Europe* with exquiſite drawings of many of the ſplendid inſects of that continent, which were afterwards engraved and publiſhed in *Holland*, about the end of laſt century †.

*Goedart* is another of the firſt authors who adorned the hiſtory of inſects with the labours of the pencil. He paid great attention to the metamorphoſes of the animals, and has painted many of them in the ſeveral forms which they aſſume, from their appearance till their death. His work was originally publiſhed in *German*, very badly ar-



* In the year 1737, under the title of Biblia Naturæ.

† Her original drawings were purchaſed by Sir Hans Sloane, and are now in the Britiſh Muſeum.

ranged; a new edition in *Latin* was afterwards given by Dr. *Liſter*, in which many errors were corrected, and a new arrangement made out by that able naturaliſt, who has himſelf written a valuable treatiſe upon the intricate genus of ſpiders.

Some of theſe authors, by the extent of their labours, and others by the boldneſs of their genius, had convinced mankind that the ancients were far from attaining that perfect knowledge of nature which they had hitherto imagined. They were now ſo far emboldened by the progreſs they had already made, that they truſted to their own judgment and obſervation in examining the works of nature; and many productions far more judicious, accurate, and philoſophical, were offered to the public, than had ever hitherto appeared. Among the firſt of theſe may be ranked that of our celebrated countryman Mr. *Ray*, who had, for the greater part of his life, aſſiduouſly examined the economy of inſects. His *Methodus Inſectorum* was not publiſhed till after his death in 1710, and may be regarded as the moſt accurate and conciſe performance on the ſubject of entymology. In the meanwhile, there appeared a numerous liſt of authors who treated this claſs of the animal kingdom; *Albin* deſcribed the inſects of *England*, while *Sir Hans Sloan*, *Petivert*, *Catesby*, and *Friſch*, have detailed the hiſtory of vaſt numbers of exotic animals of this tribe.

In this ſtate of the ſcience, about the year 1754, appeared *M. de Reaumur*, by far the moſt laborious and indefatigable entymologiſt in *Europe*. Almoſt in every part of *France* this naturaliſt had correſpondents ſtationed to tranſmit him by poſt deſcriptions and ſpecimens of every curious and rare inſect that might occur: And in order

order to examine their inſtincts, their metamorphoſes, and mode of generation, he incloſed vaſt numbers of them in a large aviary, conſtructed with a cloſe net and ſecured below with a pavement overlaid with green turf, and planted with ſhrubs and different kinds of plants. It was there that this unwearied obſerver of nature examined the manners and economy of thoſe inſects, which he has deſcribed in a work the moſt voluminous that has hitherto appeared on entymology. As a writer, he is extremely diffuſe, but always entertaining and inſtructive. The principal defect in his works is the want of a ſyſtematic arrangement, and the ſynonima of other authors; a precaution that was alone able to have prevented confuſion in ſo large a performance, and amid the vaſt number of inſects which he has deſcribed. Theſe defects, however, were ſoon remedied by that excellent arrangement which the immortal author of the Syſtema Naturæ has introduced into entymology, as well as every other department of natural hiſtory. No philoſopher hath ever yet appeared who poſſeſſes the ſame powers of claſſifying the different productions of the various kingdoms of nature; and his ſyſtem will probably long continue to be a ſtandard to all thoſe who ſhall afterwards attempt to make improvements, or to enlarge the boundaries of natural hiſtory.

Since 1715, when the ſyſtem of nature was firſt publiſhed by *Sir Charles Linnæus*, various improvements have been made on it by that author, who has enjoyed the rare felicity, not only of ſeeing his works gain univerſal approbation, but of many opportunities of bringing them nearer to perfection. In the mean time *Geoffry*, *Scopoli*, *Wotton*, *Harvey*, *Valiſnieri*, and many others of in-

ferior note, have turned their attention to this intereſting part of natural hiſtory; and while they have endeavoured to improve upon the arrangement of the *Swediſh* naturaliſt without ſucceſs, have nevertheleſs added greatly to the number of inſects. Among this number *De Geer* a *Swediſh* nobleman, councellor to the king, may be ranked in the firſt ſtation: He has publiſhed a large treatiſe upon this ſubject, in which he has not only deſcribed a great number of inſects with accuracy, but has indulged in philoſophical remarks upon their hiſtory, which poſſeſs very conſiderable merit.

Beſides theſe, a number of entymologiſts have appeared, who have given moſt elegant engravings of inſects; among which are, *Roeſel*, *Lewenhock*, *Baker*, *Barbut*, *Harris*, and *Drury*. Some of theſe have improved this ſcience by microſcopical obſervation: the laſt has given excellent drawings of the exotic inſects, while *Harris* has applied himſelf ſucceſsfully in delineating thoſe of *England*.

After reviewing the numerous liſt of authors who have laboured in the ſame field, we ſhould widely err, were we to conclude that the ſcience of entymology had reached perfection, or that the whole of this claſs of beings had been fully made known. The far greater part of inſects, as we have already hinted, from their extreme minuteneſs, elude the obſervation of the naked eye: many, it may be preſumed, are not perceptible even by the aſſiſtance of the beſt microſcope; and of theſe ſmall animals, whoſe bodies are ſcarcely diſcernible, how little can we know of their organization, their food, their manners, and their hiſtory? In the lateſt edition of the ſyſtem of nature, near three thouſand inſects are enumerated by *Linnæus*:

*Linnæus*: There is, however, good reaſon to apprehend, that this enumeration does not contain above one half even of the larger inſects that are diſtinctly obſervable by the eye. Whether in a hot or cold climate, it is probable that the number of inſects in every country is greater than that of plants. In *Sweden*, there have been enumerated, and pretty accurately deſcribed, about one thouſand ſeven hundred inſects, while the number of plants, though no where more accurately examined than in that kingdom, do not exceed thirteen hundred. In the neighbourhood of *Paris*, there have been diſcovered by *Geoffrey* and *Reaumur*, upwards of one thouſand four hundred inſects, while the plants of the ſame diſtrict, which have been ſtill more accurately examined than the inſects, do not nearly amount to that number.

The *Britiſh* inſects have never yet been either fully enumerated, or accurately deſcribed. Dr. *Berkenhoot*, in his outlines of the natural hiſtory of this iſland, has enumerated five hundred and ſeventy-two different ſpecies: In all probability, a more complete inveſtigation would diſcover three, or perhaps four times that number of *Britiſh* inſects. The nearer any country approaches to the equator, the more numerous will be the inſects found in it: Even in theſe northerly climes, however, there is ſtill much room left for entymological inveſtigation. If, in travelling over this ground, we cannot flatter the reader with much new matter, we can at leaſt aſſure him, that he will not be led aſtray by theory, or deceived by unauthenticated narrations.

## SECT. III.—*A comparative view of the Senſes and Endowments of Inſects, with thoſe of other Animals.*

THE more cloſely we examine this claſs of the animal kingdom, the greater number of ſurpriſing facts and wonderful inſtincts ſhall we find, to indemnify us for thoſe large portions of the marvellous, of which we ſhall often be obliged to diveſt their hiſtory. Many entymologiſts, it muſt be allowed, particularly thoſe who wrote in the earlier ſtages of this ſcience, before philoſophy had thrown much light upon the operations of nature, from a deſire of filling the reader with the ſame admiration which they themſelves felt, have much oftener had recourſe to the marvellous, than can either be juſtified by facts or obſervation. Thoſe eulogies which we find ſo frequently beſtowed, without meaſure, upon the intelligence of certain inſects, afford pregnant evidence of this indiſcretion. There is hardly any kind of knowledge, endowment, or even moral virtue, of which ſome or other of them has not been ſaid to be poſſeſſed. They have been made to act and think like men; and ſometimes have been celebrated for accompliſhments of which few of theſe lords of the creation can boaſt; and all this on the moſt puerile and falſe foundations. For example, there is a ſpecies of the mantis, with long limbs, and of an uncommon appearance; and becauſe this animal is frequently ſeen in an erect poſture, having the two fore legs

legs croſſed, it has been ſaid to be employed in devotion; a circumſtance from which it has in ſome parts obtained its name *.

The ſame inſect is ſaid to have ſuch a regard for children, that, ſhould one loſe its way, it humanely points to the proper way with its leg, and ſeldom is known to give a wrong direction. Of this kind, too, is the reſpect for their dead, which has been aſcribed to the ants, and the decency with which they beſtow the honours of interment upon their deceaſed friends. Theſe reports reſt upon no better foundation, than that theſe animals, and ſome ſpecies of bees, are ſeen carrying from the hive ſuch as have periſhed or been killed. How many wonders of a ſimilar kind have been told of the common bee; wonders which render the greater part of the early treatiſes upon them hardly more inſtructive than a romance. Their aſſociations have been deemed a perfect model of a monarchical government, conducted by one ſovereign, whoſe commands are implicitly obeyed, and regulate all the different operations in which they are ſo buſily employed. From farther inveſtigation, however, this king of the bees has a queen, and ſo prodigiouſly proliſic, that from three or four, which are to be found in every hive, the whole progeny, which conſiſts of many thouſands, is derived.

The different operations which inſects perform, no doubt oblige the naturaliſt to aſcribe to them a certain degree of intelligence; ſome degree of it we have ſeen poſſeſſed by the other animals: From analogy, therefore, we may reaſonably ſuppoſe them not altogether deſtitute of ſagacity. The different proceſſes through which they go,

* Vide Muoſſet, p. 118. In Provence, it is called the God-prayer.

go, are so uniform, and that succession of actions which we see them perform, are so little varied, that nature seems to have destined them to act a subordinate part in the great republic of animals. If their history sometimes exhibits them varying their procedure, and accommodating themselves to circumstances, the sphere of their address seems to be confined within narrow limits; and it is seldom that they attract our admiration by any extraordinary efforts of sagacity. The bee and the ant present striking instances of assiduity in labour; they have, however, but one single method of operating, and, withdrawn from that, can turn to no other. A bee taken out of the hive is totally helpless and inactive; far from displaying the sagacity of the dog, it seems incapable of giving the smallest variation to its instincts. In the pursuits of the latter animal, there appears something like choice; in the labours of the former, the whole appears like necessity or compulsion *.

The conformation of the whole insect tribe seems also to argue its inferiority to many other parts of animated nature. In the external and internal structure of the body of one of these small animals, where every member appears completely formed, and co-operates with the rest in carrying on the vital functions, there is no doubt displayed a very wonderful organization. Insects, however, of all animals, are perhaps the most imperfectly formed; nor is this assertion founded on any investigation made upon these minute creatures by means of the eye, or the knife of the anatomist; it is obviously deducible from their capacity of subsisting after being deprived of many of those members and organs, which, in the higher ranks of

* Goldsmith's Nat. History, Vol. VII. p. 236.

of nature, are abſolutely neceſſary to life. Many of them, like the nobler animals, are furniſhed with lungs, and an heart; yet the caterpillar lives, though its heart and lungs, as is often the caſe, are entirely eaten away. In ſome, the ſtomach periſhes altogether, and is again renewed; others, after being cut into ſeveral pieces, not only continue in life, but are formed into as many new diſtinct animals as there were ſegments of the old! As in mechanics, the moſt complicated machines are required to perform the niceſt operations, ſo, in anatomy, the nobleſt animals are moſt variouſly and wonderfully made *. Of all living beings, man offers the moſt wonderful variety in his internal conformation; quadrupeds come next; and after them the other animals follow, in proportion to their powers and excellencies; while inſects ſeem to fill up the laſt and loweſt rank of animated nature; ſome of them being ſo imperfectly organized, that they have long remained in the ſyſtems of naturaliſts confounded with the vegetable tribes.

The amazing number of inſects is another argument of their imperfection. It is a rule which obtains among the offspring of nature, that the nobler animals are ſlowly produced, and that, in forming theſe, ſhe acts with a dignified economy; while, in her meaner births, ſhe is often laviſh to profuſion; and thouſands of the more ignoble kinds are produced merely to ſupply the neceſſities of the more favoured and delicately organized parts of her creatures. Of all the other productions of nature, we have ſeen that inſects are the moſt numerous: that, however minute when taken individually, when taken together they are probably more bulky than all the reſt



* Idem, ubi ſupra.

of her animated offspring. The plants and vegetables which cover the furface of the earth, and which at firft fight appear fo far to outnumber the other productions of nature, upon a clofer inveftigation, are found far inferior in number and variety to the infects which fwarm in the wider range of the air, the earth, and the water.

From thefe confiderations, we are induced to believe, that the degree of intelligence allotted to this clafs of the animal kingdom is but very fmall; and our experience, as far as it goes, coincides with this opinion. While other animals are capable of fome degree of education, thefe have one invariable mode of operating, which no art can either alter or improve. The dog is taught to carry; the bird to whiftle a tune; but thofe infects which may be confidered as completely domefticated, can by no invention be turned from their inftinct. The filk worm completes its labours, and the fpider conftructs its web, invariably in the fame manner: An exiftence which continues but a fingle feafon, feems too fhort for the purpofes of inftruction, or of learning. Hence the infects are not only of a rank inferior to the other animals, but many of them feem more nearly allied to the vegetables than to the claffes above them. Many are attached to one vegetable, fome to a fingle leaf, where the period of their lives is completed in a few weeks, or perhaps a few days, and where the pleafures they enjoyed, or the purpofes for which they were produced, are in a great meafure beyond the reach of our faculties to explore.

The external fenfes of infects, as far as we are enabled to judge of them, correfpond with the low meafure of fagacity which the Author of nature has aſſigned them: Of fome of them they feem altogether deſtitute, while others are enjoyed but in an imperfect manner. It has

long been a received opinion, that hearing is denied to infects; or at leaſt, that the exiſtence of this ſenſe is very equivocal. Many of them, however, are endowed with the power of uttering ſounds; as the bee, the fly, the gnat, and the beetle. The *ſphinx atropos* ſqueaks when hurt, nearly as loud as a mouſe; it has even the power of uttering a plaintive note, in certain circumſtances, which excites commiſeration. In general, the power of uttering ſounds agreeable to the feelings and neceſſities of animals, is conferred on them for the purpoſe of communicating theſe feelings to the reſt of their kind. We have already ſeen, that ſuch of the finny tribes as were vocal, were alſo endowed with organs for the reception of ſounds; the ſame, probably, is the caſe with the inſect tribe. For what purpoſe is the individual poſſeſſed of the power of expreſſing its pleaſures or its pain, if all knowledge of ſound is denied to its tribe? Were the ſenſe of hearing withheld from the animals of the ſame claſs, it muſt crave aſſiſtance in vain; for it muſt ſpeak a language deſtined to be unintelligible to every being in nature *.

Experience daily convinces us of the truth of the foregoing poſitions. If a bee or waſp be attacked near the hive, the conſequence of this aſſault commonly is, that the animal expreſſes its pain or indignation in a tone different from its ordinary noiſe; the complaint is immediately underſtood by the hive within, when the inhabitants hurry out to revenge the inſult, in ſuch numbers that the offending party ſeldom comes off with impunity. The ſame evidence of hearing is continually afforded by the ſpider: Often his webs are of ſuch an enormous

 length,

* Vide Barbut's Genera Inſectorum, p. 4.

length, that he cannot ſee from the one end of them to the other; often too, in watching for his prey, he conceals himſelf in ſome adjoining crevice, where he cannot ſee thoſe animals that are enſnared in his toils. The fly, however, no ſooner finds itſelf entangled, than it makes a buzzing noiſe, in order to eſcape; this noiſe is inſtantly heard and underſtood by the ſpider, who ſallies forth from his concealment, and riots in the ſpoil, with all the eagerneſs and ferocity which diſtinguiſhes the moſt rapacious animals *.

If the ſenſe of hearing has with difficulty been allowed to inſects, naturaliſts have had ſtill more in aſcertaining the place or organ where that ſenſe is ſituated. The moſt accurate obſervers of nature have ſuppoſed it to be placed in the *antennæ*: Theſe, from their ſituation in the head, from their inward ſtructure, and their capacity of motion, have been ſuppoſed moſt favourable for the ſeat of ſuch organs. Beſides, it is difficult to aſſign any other uſe for theſe inſtruments, which are common to almoſt the whole of this claſs of beings. From their extreme ſenſibility, they ſeem neither fitted for the purpoſes of attack nor defence: While, then, it is certain that providence hath made nothing in vain, but hath framed every limb of the ſmalleſt animal for uſe, as well as ornament, it ſeems to follow, that the antennæ of inſects are the appointed organs of hearing, ſince there is apparently no other purpoſe in the economy of theſe animals which they ſeem fitted to ſerve.

The antennæ of all inſects are compoſed of joints, varying in form, ſize, and number. Among thoſe which are confined to live moſtly under water, as the *gyrinus*, they

* Genera Inſectorum, ubi ſupra.

they are in general ſhort; while ſuch as roam at large through the air have them long and ſlender, as the phalenæ ichneumons, and others. They are all hollow within, and rendered flexible by the joints, which are very viſible in thoſe of the crab; which are the beſt examples, becauſe the largeſt belonging to this claſs of beings. This hollowneſs, it is ſuppoſed, is intended to receive the ſound communicated to the extremities of the antennæ, by the repercuſſion of the air; and to convey it, by means of the joints, from one piece to another, till it arrives at the brain, in that leſſened degree of tone which is ſuited to the nature of the particular animal *. Such is the apparatus deſtined for the hearing of inſects; a ſenſe which they probably enjoy in various degrees of perfection; but in none of them does it ſeem ſo acute as in the higher ranks of animated beings.

But, beſides the ſenſe of hearing, it ſeems highly probable that inſects poſſeſs alſo that of ſmell. As many of them live on bodies in a ſtate of putrefaction, around which, when expoſed, they are ſeen immediately to collect themſelves, the concluſion ſeems obvious, that they are poſſeſſed of organs fitted to direct them to their food. Thoſe which feed on herbs, flowers, or fruits, ſeem in the ſame manner to require ſenſes adequate to their purſuits. It has therefore been ſuppoſed, and not without an appearance of probability, that the *palpi*, or feelers, are the organs of ſmell in the inſect tribe. Theſe inſtruments are four, ſometimes ſix in number; two of which are evidently deſtined to the purpoſe of handling their food, and conveying it to the mouth. The others, which are in continual motion, and conſtantly applied to thoſe objects

* Genera Inſectorum, ubi ſupra.

objects on which they alight, ſeem employed, like the ſnout of a hog, in ſearching for food, and examining the quality of the different kinds of ſuſtenance by which they are ſupported. The beetles, and other tribes whoſe *palpi* are large, are proper ſubjects for examining the organs of ſmell in this claſs of beings; and an accurate inveſtigation of their manners would probably juſtify the foregoing conjectures with regard to the uſes of the feelers, and determine how far they poſſeſs this ſenſe.

The organs of viſion among moſt kinds of inſects are large; a circumſtance which has put their ſenſe of ſeeing beyond a doubt. The eyes are commonly two in number, each frequently conſiſting of a congeries or aſſemblage of *lentes*, covered with a cruſtaceous tranſparent ſubſtance, to protect them from injury. The organs which have been allotted to hearing and ſmell, are alſo protected from duſt, and the ſmaller particles of thoſe ſubſtances to which they are applied: Their extremities are not patulous, but ciliated, like thoſe of the mole, to prevent them from being clogged or injured by the intruſion of ſurrounding objects. Hence it appears, that though inſects are deſtined to fill a ſubordinate ſtation in the animal kingdom, yet nature has by no means neglected them, but furniſhed them with organs wonderfully adapted to their humble purſuits, and to that tranſient exiſtence which ſhe has aſſigned them.

## Sect. IV.—*Of the External Parts and Claſſical Characters of Inſects.*

Insects have always been conſidered as a diſtinct claſs of the animal kingdom, though naturaliſts have not agreed in aſcertaining its limits. The ſhades of nature are indeed intimately blended together; and thoſe links by which ſhe connects different portions of her animated offspring, are often ſmall and imperceptible. The inſect tribe comprehends thoſe ſmall animals which are deſtitute of red blood, bones, and cartilages; which are furniſhed with a mouth, or elſe a trunk, opening lengthwiſe; and which breathe by means of ſtigmata, or apertures upon the external parts of the body. They have obtained the name of inſects from the frequent inciſions by which their bodies are apparently divided into ſeveral parts or ſegments.

The body of theſe animals is divided by naturaliſts into a head, thorax, abdomen, and limbs. The head is, for the moſt part, diſtinct from the thorax, being attached to it only by a ſlender tendon, and is furniſhed with eyes, palpi, and antennæ, which we have already ſeen are the organs of the different ſenſes. This whole tribe of animals is ſuppoſed by *Linnæus* to be deſtitute of brains *.

The antennæ are organs peculiar to inſects; and according to their various forms and proportions, afford ſyſtematic

* Vide Syſtema Natura, Tom. I. Part I. p. 533.

ſyſtematic writers the moſt proper characters for the arrangement of thoſe animals. According to their form, they are either ſetaceous, filiform, moniliform, clavated, capitated, fiſſile, pectinated, or bearded; and in their proportions, they are either longer than the body, or ſhorter, or of equal length with that part.

The *feelers* have already been noticed, as conſtituting the organs both of touch and of ſmell; and have two, three, and ſometimes four joints. Some inſects are ſaid to have no mouth; in general, however, that organ is ſituated under the head, and to it the feelers are attached: In ſome ſpecies, the mouth is placed under the breaſt; in others, the roſtrum is of conſiderable length, having an upper lip, tranſverſe jaws, teeth, and a tongue, not unfrequently roiled up in a ſpire. The ſtemmata, or ſmall eyes, are three brilliant convex ſpots, ſituated upon the crown of the head.

The thorax is placed between the head and the abdomen, and is that part to which the *fulcra* or limbs are attached: immediately behind it is placed the abdomen, containing the ſtomach and viſcera. It is divided into five ſegments, each pierced on the ſides with ſmall foramina for the purpoſe of breathing. It was long imagined, that all the animals that are deſtitute of red blood lived without reſpiration: It has, however, been found by experiment, that this is not the caſe; and that, among the inſect tribes, breathing is carried on, though in a different manner, from what takes place among the larger animals. Inſects are all furniſhed with minute organs, which, in the language of naturaliſts, are termed *ſtigmata*; theſe are a number of ſmall tubercles, ranged along each ſide of the body, each having an aperture in the top, called the ſpiracle, by which the animal breathes.

Theſe

Theſe ſtigmata are commonly ſituated on the ſides both of the thorax and abdomen; and their number is various, being from eight to twelve. When the uſes of theſe organs at firſt began to attract the attention of naturaliſts, it was imagined, that by means of them the inſect only inſpired, and that the air was ejected by the pores in the common manner, by perſpiration.

This opinion was adopted by *M. de Reaumur* *; but ſubſequent experiments have proved, that the air is both introduced into the lungs, and emitted from them by the ſpiracles: If the ſtigmata are covered with oil, reſpiration totally ceaſes, and the animal dies; if they are covered only on one ſide, the vital functions on that part are impeded, and the ſide becomes paralytic †. Nor is it in their winged and active ſtate alone, that inſects breathe. The cruſtaceous ſhell, by which the chryſalis is covered, is alſo provided with lateral ſtigmata, by which reſpiration is carried on during the period of their pupa ſtate. In the breathing of inſects, there is ſtill another peculiarity; they thrive in air tainted by putrifying ſubſtances, and are capable of ſubſiſting in phlogiſticated air, the inſpiration of which is ſo fatal to other animals.

From the limbs of inſects are obtained the moſt permanent and ſtriking generic characters; theſe are moſt commonly taken from the tail, the legs, or the wings, in ſuch ſubjects as are furniſhed with them. The tail terminates the abdomen; and ſometimes has two horns, and ſometimes none: It is either ſimple, or armed with a forceps, a briſtle, a claw, or a ſting ‡.



* Vide Memoir pour ſervir a l' hiſt. des inſectes.

† Bonnet. ‡ Barbut's genera inſectorum.

The feet of thefe animals are generally fix; the crabs and fpiders have eight, and the fcolopendra has a much greater number. They are divided into the thighs, which are attached immediately to the body; the tibia or fhanks immediately below the fecond joint; and the tarfi, which are compofed of various articulations, and are terminated by nails: The hind feet receive different appellations, according as they are formed, for executing the various movements of walking, running, leaping, or fwimming *.

The wings are in fome fubjects two, and in others four in number; and are fo various in their colour, fhape, and conſiſtency, that they afford many characters for the diſtribution of theſe animals. The elytra or wing-cafes are two, formed of a cruſtaceous ſubſtance, and for the moſt part moveable: They ſerve as a cover to the under wings, and furniſh diſtinguiſhing marks to the naturaliſt. Under the wings of dipterous infects are placed the halters or poiſers, which are compoſed of a ſmall ſtalk, terminating in a round knob or head; and are ſuppoſed to ſerve the purpoſe of balancing the animal, as is expreſſed by their *French* name †.

After this ſhort account of the external parts of infects, and explanation of the technical language by which they are expreſſed, the reader will be able to ſee the propriety of the *Linnæan* diviſion of this claſs of animals into ſeven orders; an arrangement which conſtitutes the baſis of a ſyſtem of entymology the moſt ſimple and judicious that has ever yet been deviſed.

The firſt order of infects is called the coleopterous: It conſiſts of all thoſe animals that have membrenaceous wings,

* Hence they are called, curſorii, ſaltatorii, and natatorii, &c.

† Les balanciers.

wings, covered with cruſtaceous elytra, and is ſubdivided into thirty different genera, according to the ſhape of the antennæ.

The ſecond order is called the hemipterous: becauſe the wings are half covered with cruſtaceous elytra, and are leſs hard and robuſt than thoſe of the coleopterous inſects, but more ſtrong than thoſe of the membranaceous winged inſects that compoſe the ſubſequent orders. The upper wings are ſemi-coriaceous: They do not meet together in a longitudinal ſuture, as in the firſt order; but have part of their interior margin croſſed or lapped, the one over the other along the upper part of the abdomen. The mouth and proboſcis of the inſects of this order, are bent inwards towards the breaſt.

The third order comprehends the various tribes of moths and butterflies, whoſe wings are covered with imbricated ſcales, and which on that account are called lepidopterous inſects. They have four membranaceous wings; their bodies are rough, and the mouth furniſhed with a ſpiral tongue, which they can roll up, or unfold at pleaſure.

The neuropterous inſects conſtitute the fourth order, which comprehends all thoſe genera which have four naked and membranaceous wings, reticulated with veins. The tail of theſe animals is unarmed, having no ſting, but is provided with appendices like pincers, by which the ſexes are diſtinguiſhed.

The inſects of the fifth order have the tail armed with a ſting, excepting the males, which have not that offenſive inſtrument. They have four membranaceous wings, and are called the hymedopterous inſects.

The ſixth order contains the depterous inſects, or ſuch as have only two wings: They are farther diſtinguiſhed

by a poiſer ſituated under each wing, the baſe of which is covered by a ſmall ſcale, and the extremity terminates in a knob.

The laſt order comprehends in it all the apterous inſects, or ſuch as are entirely deſtitute of wings in either ſex.

In giving the hiſtory of a claſs of animals ſo extremely numerous as that of inſects, it becomes abſolutely neceſſary to group them in certain tribes, whoſe manners or external characters correſpond: Nothing but this expedient can prevent endleſs confuſion among ſuch multifarious forms, or afford any proſpect of finiſhing a taſk, that, at firſt view, ſeems involved in ſuch inextricable difficulty. All naturaliſts who have treated of this part of the animal kingdom, have accordingly endeavoured to arrange them into orders and genera. *Swammerdam* and *Ray* ſeem to have founded their ſyſtems on the different changes which theſe animals undergo, and have formed them into four great diviſions, agreeable to the different forms under which they appear: *Valiſnieri* has alſo diſtributed them into four orders, according to their habitation; arranging together in one group, ſuch as inhabit plants; placing in another, theſe that live in the water; and in a third, ſuch as conceal themſelves under the earth or ſand; reſerving for his laſt diviſion, thoſe that inhabit the bodies of other animals *. Both thoſe ſyſtems are defective, in having too few diviſions of a claſs of animals ſo extremely numerous; the laſt, however, is liable to an imperfection of another kind; becauſe many inſects change their habitation, at the moment of their metamorphoſis. Some are aquatic, which, af-

ter

* Vide Nouvelle idée d'une diviſion generale des Inſectes.

ter their transformation, are ſeen inhabiting the trees and plants; many of the ſubterraneous inſects in like manner riſe into the air, ſo ſoon as they arrive at their winged ſtate. Several other attempts have been made towards the arrangement of inſects, none of which ſeem to have been ſo ſucceſsful as that of the *Swediſh* naturaliſt above deſcribed: By his ſyſtem, therefore, we ſhall be chiefly guided in the following ſketch of the hiſtory of theſe animals.

## SECT. V.—*Of the Generation and Metamorphoſis of Inſects.*

WE have already noticed the erroneous opinion which the ancients entertained concerning the generation of inſects, and mentioned the efforts made by *Rhedi* and others, in order to combat it: After all their reſearches, however, this part of our ſubject is far from being free of difficulty. Inſects are remarkable for a greater variety of ſexes than any other claſs of animals. In general, each individual is either male or female; but there is one order (that of the hymenoptera, which comprehends all the numerous tribes of bees, waſps, hornets, and ants), among which there is found a numerous race of animals that are neuters. Theſe take no part in propagating the different ſpecies to which they belong, but ſeem devoted to the ſervice of the more perfect animals. This fact is fully

fully aſcertained by the hiſtory of the common domeſtic bee: all thoſe which are employed in collecting the honey, and conſtructing the cells, and which conſtitute by far the greater part of the hive, are of the claſs of neuters, to whom nature has denied the power of propagating their kind. It is only upon the drones, and one or two females in each hive, that ſhe has conferred the ſexual diſtinction, and the powers of generation.

Hitherto we have uniformly beheld animals either male or female; and the neuters of the order of hymenoptera which form the firſt exception to the general law of nature, appear not only an anomalous but a defective race. The hiſtory of inſects exhibits another inſtance of animals deviating from this rule, from a different cauſe. All the animals belonging to that genus, termed the *aphus puccron*, appear to be hermaphrodites of the moſt perfect kind: A ſingle animal of this tribe, though kept in the moſt careful manner from every other, will propagate its kind by itſelf; and if the offspring thus produced be preſerved, it will alſo breed. An ingenious naturaliſt has well aſcertained this fact by experiments, which he has repeated to the ninth generation*.

This mode of generation, ſo different from that effected by the joint co-operation of the ſexes, naturaliſts have aſcribed to a different power, ſomething reſembling that poſſeſſed by the vegetable tribes: We have already, however, ſeen inſtances of animals among whom fecundation by the male, impregnated the females for ſeveral generations. If that fact be well aſcertained, it will explain the peculiarity of that tribe, without inveſting it with powers ſo different from all thoſe poſſeſſed by the reſt of the animal kingdom.

Inſects

* M. Bonnet.

Infects are in general oviparous, producing eggs which are gradually quickened into life, by the joint influence of the heat of the ſun, and of thoſe warm ſubſtances which conſtitute their nidus. *Bonnet* mentions ſome inſtances in the order of diptera, in which the parent inſect produces living young. The genus aphlus exhibits a ſingular phenomenon. This animal, during ſummer, is viviparous, but towards winter becomes oviparous; the ſtate of its progeny being determined by the nature of the ſeaſon.

The nidus in which the eggs of inſects are depoſited, is generally choſen with admirable ſkill; being adapted equally to the ſecurity, warmth, and ſubſiſtence of the future larvæ that are to be reared in it. Some conſtruct their neſts in the earth with great labour: others depoſite their eggs upon thoſe plants, the leaves of which are to ſupply food for the naſcent brood: while ſeveral of the muſcæ eject their eggs in the body of the chryſalis of other inſects; upon the juices of which the young are nouriſhed at the expence of the defenceleſs animal which they devour. Inſtinct is an unerring guide in directing each of theſe animals to a nidus fitted for the preſervation of the *ova*. In one inſtance, the common blue fly is ſaid to be deceived; and that is, when it depoſits its eggs upon the flower of a certain plant of a putrid ſmell, miſtaking it for fleſh in a ſtate of putrefaction. There the young are no ſooner quickened into life than they die for want of proper food *.

The

* The ſkin, the noſtrils, the anus, and viſcera of quadrupeds, ſometimes furniſh a receptacle for inſects; and there nature directs the parent animal to depoſit its eggs.

The different changes of form which many infects undergo, from their firſt appearance as eggs, till they arrive at their perfect and winged ſtate, conſtitute an important article in their hiſtory: Theſe have been termed their metamorphoſes, or transformations; and, from the very language employed to expreſs them, the falſe notions which were long entertained, even by naturaliſts, are ſtill diſcernable.

A fly, a ſpider, or an ant, inſects of the moſt different kinds in outward appearance, do not differ more widely than the ſame inſect does from itſelf, under the different forms of a worm, a chryſalis, and a butterfly. What is at preſent a worm, however, ſoon becomes a chryſalis, which is again as ſuddenly to be changed into a winged animal. Changes apparently ſo inſtantaneouſly produced, have been compared to the metamorphoſes ſo renowned in ancient fable, and probably at firſt ſuggeſted the idea of thoſe transformations which fable has rendered ſo celebrated. When an inſect in ſo ſhort a ſpace, appeared under a form ſo different from that which it lately exhibited, men imagined that the change was real: They truſted to appearances, without giving themſelves the trouble of reflecting on the improbability of the fact. They who imagined that a piece of rotten wood or putrid fleſh could become the eyes, limbs, and body of an inſect of ſuch delicate organization, and conſiſting of muſcles, nerves, veins, and arteries, could have but little difficulty in admitting, that the fleſh of a chryſalis might be transformed into the wings of a butterfly, or that the ſixteen limbs of a ſilk worm might furniſh ſix for a moth.

After true philoſophy appeared, one of the firſt leſſons ſhe gave her votaries, was to beware of truſting too implicitly to appearances, and of admitting ideas that were neither

neither clear nor intelligible: It was then that men began to recognife, that fudden metamorphofes were none of the expedients which nature employs for the production of her offspring. This point was fuccefsfully laboured by *Malphigi* and *Swammerdam*, who carefully examined thofe infects that appear under different forms. By diffecting them, a fhort time before the period of their transformation, they obferved that their firft form was owing to a covering under which their different members were to acquire their proper fize and firmnefs: That all the parts of a butterfly, for example, were perfectly diftinct under the fkin of the worm which covered them; and that under the cruftaceous fhell of the chryfalis, they were ftill acquiring greater degrees of ftrength; and were faft approaching to that ftate in which they were deftined to appear, when the animal fhould arrive at perfection, and be able to propagate its kind.

From the experiments of thefe naturalifts it appeared, that all the parts of the moft perfect winged infect were diftinctly formed, and gradually acquired fize and ftrength, under the different forms of a worm and a chryfalis, and that its progrefs and growth proceeded rather by developements, than by a real change: All the marvellous ideas conveyed by the terms transformation and metamorphofes thus vanifhed; and a beautiful analogy was eftabliflied between the growth of all organifed beings, whether in the animal or vegetable kingdoms.

A filk worm, or the worm of a butterfly, which is about to enter into its chryfalis ftate, is obferved for fome time before to grow languid, and to ceafe from gnawing thofe plants of which it was formerly fo voracious: After having retired into a place fit for its purpofe, and undergoing

dergoing a few convulsive struggles, the skin which covered it, and gave it the form of a worm, bursts, and the animal within makes its appearance; at first it is soft and tender, and covered with a viscous fluid which ascends from the body, but which afterwards hardens into that crustaceous shell in which all the members are again locked up, till they acquire greater firmness and stability. This viscous fluid, which is generally seen coloured and opaque in its crustaceous state, is at first transparent, and through it the wings, limbs, and antennæ of the butterfly, are clearly perceptible. *M. de Reaumure* collected several hundreds of these worms before their transformation, and placed them together upon a table, where he had many opportunities of examining them as they passed from the one state to the other: It was then that he distinctly perceived all the different members of the butterfly, before the chrysalis had assumed its hard and apparently inanimate state *.

After having remained for some time in this torpid state of a nymphe, chrysalis, or pupa, the limbs of the animal acquire sufficient strength to perform their functions; and it employs them in breaking open the second prison. On this event all the members are set at liberty, and instantly assume that posture and arrangement which is most suited to the new functions with which they are now to be charged: By these different processes does the butterfly arrive at that state in which it possesses all the faculties which are enjoyed by the most perfect of its kind.

All insects do not undergo the same number of transformations before they arrive at the winged state.

Some

* Vide Memoires pour Servir a l'hist. des insectes, tom. i. p. 354.

Some, immediately on leaving the egg, aſſume a form pretty nearly reſembling that which they poſſeſs after their growth is completed. The whole order of aptera, which comprehends all the different kinds of ſpiders, come under this denomination: The viviparous inſects, in like mannner, appear at firſt, under their moſt perfect form. Some kinds, without undergoing all the changes of the ſilk worm, or that of the common butterfly, after having grown for a certain period, depoſite a covering in which their wings were inveloped, and aſcend into the air. Previous to this change, however, theſe enjoyed the power of locomotion by means of their limbs, and in that ſtate were diſtinguiſhed by voracity and activity: Of this deſcription are all the different ſpecies of locuſts. The flies, waſps, and bees, conſtitute another claſs, which, after leaving their vermicular form, and after paſſing into their chryſalis ſtate, diſplay their limbs and wings without being capable of uſing them. The laſt and moſt complete example of transformation is diſplayed by the claſs of moths and butterflies. On leaving the egg, and even before it, they aſſume the form of worms, which they again change for that of the nymphe, aurelia, or chryſalis: and it is not till they have lived a conſiderable time under this form, that they throw off a ſecond covering, and come forth winged inſects.

One of the moſt wonderful circumſtances in the economy of inſects, is the different preparations which they make, and the expedients to which they have recourſe for their preſervation in their aurelia ſtate. Many dig a hole in the earth, where they remain during the whole period of their inactivity. This is the invention of all the coleopterous inſects, or ſuch as have cruſtaceous wings. The

gnats, on the other hand, go into water, where they remain till the period of their winged ſtate arrives. Some eat their way into ſeeds and fruits, where they undergo the different changes previous to their appearance on wing. Many lodge themſelves in animal bodies on the approach of their transformation; ſeveral of the aquatic tribes bury themſelves among ſand, encruſted with a glutinous ſubſtance; while the numerous race of phalenæ wrap themſelves up in the leaves of trees, the bombyces, or larger kinds, conſtituting for themſelves a ſilken web, to protect them during that trying viciſſitude of their lives.

In general, all inſects provide for their ſecurity before their helpleſs ſtate arrive, by retiring from their uſual haunts into ſome ſheltered retreat. It is thus that the worm of the butterfly provides for its ſafety, by betaking itſelf, while it has yet the power of motion, to the hole of a wall, or the eave of a houſe: There ſome are ſuſpended by a thread, which nature aſſiſts them in providing; ſome hang by the head, others by the oppoſite extremity, and many by the middle. The cruſtaceous covering with which they are then clothed, affords another inſtance of the attention paid by nature to the preſervation of her off pring, during a period when they are not able to avoid external injury by flight. Thus protected by the munificence of providence, myriads of animals ſink annually into a ſtate of torpor ſo profound as appears to threaten the extinction of every vital power. At the return of Spring, however, all nature ſeems again to quicken into life; her ſervants awaken from their torpid ſtate, and enter upon their functions with enlarged powers.

## Sect. VI.—*Of the Habitation and Food of Infects, and their Uſes in the Economy of Nature.*

It has been aſſerted by *Ariſtotle*, that every kind of quadruped and bird was inhabited by its peculiar inſect *; and this aſſertion, which has never been contradicted, ſeems to admit of being much extended. We have already ſeen, in a former part of this work, that the ſalmon and cod were at certain ſeaſons infeſted with inſects; the ſame is probably the caſe with many other ſpecies of the finny tribe, whoſe hiſtory is leſs completely known. Some particular animals afford food and reſidence to different kinds of inſects; and the ſame is the caſe with plants. As one animal is often ſeen to feed upon and inhabit a great many different plants; ſo the ſame plant often ſupports a variety of inſects. The oak, in this country, affords ſuſtenance to twenty different ſpecies of theſe animals; and there are varieties of this tree in warmer climates, that ſerve for food to a far greater number.

Plants afford the moſt general and copious pabulum for this tribe of the animal kingdom. Wherever any inſect is found indigenous in a country, there will always be found in it plants accommodated to its wants. There are many inſects attached uniformly to one plant; the ſilk worm always gives a decided preference to the mulberry,

* Hiſtoria Animalium.

berry, but will live and propagate, though leſs vigorouſly, upon the common lettuce.

There are other inſtances of the attachment of inſects to particular plants, equally conſtant with that of the ſilk worm; and by means of theſe, the animal is often known from the place where it was found to reſide. Hence *Linnæus* has frequently given them names from the plants upon which they feed; a method often fallacious; ſince, perhaps, the greater number reſide indiſcriminately upon ſeveral plants, and ſupport themſelves upon a variety of different vegetable food. Some are aſſerted to be capable of reſiding in the human inteſtines, and undergoing their transformations there; being ejected from the ſtomach in their winged ſtate.

The moſt poiſonous herbs afford food to inſects equally with thoſe that are ſalubrious: The water-hemlock, which is conſidered as the ſtrongeſt vegetable poiſon, is much frequented by many of thoſe animals, and ſeems to conſtitute their favourite nouriſhment.

In the different ſtages of their lives, inſects are diſtinguiſhed by various degrees of voracity; many of them in their larva ſtate are moſt inſatiable: The different ſpecies of the butterfly and ſilk worms are then endowed with teeth, with which they make great havock among leaves, even though of a pretty ſtrong conſiſtency; their ſtomachs in that ſtate being capable of diſſolving theſe harder ſubſtances. The ſame animal, when a chryſalis, loſes all appetite for food, and thoſe inſtruments that were employed in comminuting it. The teeth are depoſited with its firſt covering; and the inner coats of the ſtomach are voided, it is ſaid, along with the excrements, a ſhort while before the firſt transformation *. After being liberated from their

* Memoir pour ſervir l'hiſt. des inſectes par M. de Reaumur.

their laſt ſtate of confinement, the butterflies are far inferior in voracity and in the powers of digeſtion; their food being then a thin liquid ſubſtance collected from the leaves of plants, and devoured only in ſmall quantity.

The ſame is the caſe with the different ſpecies of locuſts; ſome of which in their larva ſtate are the moſt voracious of all animals, and deſolate entire provinces. It is not till they arrive at their winged and more perfect form, that their depredations ceaſe, and mankind are relieved from one of the heavieſt calamities which fall upon the human race in the ſultry climates. It is by inſects in their larva ſtate that the roots of corn are perforated and devoured in more northerly countries. If the ſeaſon prove cold and wet, they continue long under ground in that ſtate of voracious vermine; and the crop, in the mean time, is ſo completely ate away, that in ſome inſtances, ſcarcely a tenth ſtalk ſurvives their depredations. In a more genial ſpring, theſe animals continue for a ſhorter ſpace in their aurelia ſtate; and the damage done by them is proportionably leſs; their deſtructive operations below ceaſing as ſoon as they are enabled by their wings to riſe into the air, and go in queſt of ſuſtenance in another element.

Inſects, even in their winged ſtate, all take food in a greater or leſſer quantity; it ſeems, however, to be of a more delicate nature, being often only the liquid ſubſtances that exude from vegetables. Some are ſaid, indeed, to be ſo ſhort-lived, that they do not require any ſuſtenance, and have, as it is aſſerted, no mouths: Of this kind are the ſphemera, the may-fly, and the gad-fly. This fact, however, would require a more accurate degree of examination, and more ſatisfactory proof than has

has ever yet been adduced, to eſtabliſh it. The ſmalleſt and moſt delicate inſects, for ought our ſenſes can diſcover, may find various particles of matter floating in the air that may ſerve for their ſupport; the effluvia continually emitted by animal and vegetable ſubſtances in a ſtate of putrefaction, probably ſupport many of this claſs: We know at leaſt, that ſeveral fiſhes are capable of living upon the earthy particles that are found floating in the pureſt water; and if animals of that ſuperior ſize are thus ſupported, there can hardly be any room to doubt that inſects, many of whom are ſcarcely perceptible, may find abundant ſubſiſtence in the air, impregnated as it is with various effluvia.

The economical uſes of inſects, and their noxious effects upon the various objects of human induſtry, have already been conſidered *; it now remains, that we point out the purpoſes which they ſerve in the general ſyſtem of nature. A claſs of beings by far the moſt numerous upon the face of the globe, and however ſmall taken individually, yet forming collectively a maſs of organiſed matter, ſuperior in bulk to any other department of the animal kingdom, every perſon will admit, could not be originally formed for no purpoſe, nor continue to be propagated without anſwering ſome important uſes in the economy of nature.

The firſt and moſt obvious uſe of this part of the animal kingdom, ſeems to conſiſt in that large ſupply of proviſion which it affords the ſuperior ranks of animated beings. It is for this important purpoſe that the whole ſurface of the earth is annually covered with plants and herbage; and many, perhaps the greater part of the larger animals are ſupported by the immediate pro-

duce

* Sect. I.

duce of the vegetable kingdom; not a few, it muſt be allowed, are alſo ſuſtained by devouring animal food. Between theſe two ſpecies of nouriſhment there is a wide difference; and inſects afford a ſpecies of nutriment which ſeems to partake ſomewhat of the nature of both, and which ſupplies the wants of an infinite number of creatures whoſe conſtitutions are not wholly adapted to either. Many kinds of birds live upon hardly any other food. What a blank in the feathered race would enſue, were this copious ſource of proviſion ſhut up from that part of the animal kingdom! The fiſhes ſeem ſtill more dependent on the ſupplies afforded by thoſe numerous tribes of inſects that either float upon the water, or are ſeen hovering over its ſurface. The whale, the largeſt of nature's animated offspring, as we have already had occaſion to obſerve, is ſupported ſolely by an inſect which it finds floating upon the waves. Among this claſs alſo, an inconceivable diminution of numbers would neceſſarily enſue, were the food of inſects denied to the inhabitants of the water. Farther, many of the larger inſects prey upon the ſmaller; all theſe, as well as the different animals they ſupport, muſt be unavoidably ſtruck out of the family of nature the moment this ſpecies of ſupport is withheld.

By means of the food of inſects, therefore, a large proportion of the ſuperior ranks of animated beings are ſupported, all which would of neceſſity periſh, were this order of animals deſtroyed. What a dreadful chaſm in the works of nature would the annihilation of a claſs of beings occaſion, which of itſelf conſtitutes ſo large a proportion of her living productions, and which preſerves the exiſtence of ſo many more! The air, the earth, and the ſea, which, according to the preſent ſyſtem, teem with

life, would thus be more than half depopulated; and that great vivifying principle by which nature is actuated, and by which life is multiplied and carried on in all the elements without a pauſe, would then be exerted in a great meaſure in vain.

But beſides the ſupply of food which inſects afford to the ſuperior animals, and their proving the grand inſtruments in the hand of nature by which ſhe ſupports life throughout her dominions, they have always been deemed ſerviceable in the general ſyſtem, by preſerving the ſalubrity of the air. Over the whole ſurface of the earth, thoſe numberleſs productions that enjoy either animal or vegetable life, are continually falling into decay, and making room for that ſucceſſion of organized beings with which nature conſtantly teems: Hence, it has been ſuppoſed, that the atmoſphere would ſoon become unfit for the ſupport of life, did not millions of inſects continually conſume the carrion, and other ſubſtances in a ſtate of putrefaction, and purge the air of the noxious effluvia emitted from them. It is probably the office of thoſe ſmall inſects who eſcape our obſervation, to deſtroy thoſe noxious particles with which that element is impregnated, and which at certain ſeaſons render it peſtilential. The operation of this claſs of animals upon putrid ſubſtances, is much more conſiderable than a ſuperficial examination might ſuggeſt. It has been aſſerted by the moſt judicious and diſcerning naturaliſts, that the produce of a dozen of flies will conſume a dead carcaſe in a ſhorter ſpace than a hungry lion. If this be true, what beneficial effects may be produced by that inconceivable number of inſects, which in warm countries continually ſwarm in the air?

# CHAPTER II.

## ORDER I.—*Coleopterous Insects.*

THIS order comprehends all those insects which have their wings covered by crustaceous elytra, and is divided into three sections, distinguishable by their antennæ: The first includes such as have their antennæ in the form of a club, thickest at the farther extremity; the second comprehends those whose antennæ are uniform, or of equal thickness throughout; and the third is reserved for those insects that have cetaceous antennæ, tapering from the base to their extreme points. There are thirty genera of coleopterous insects enumerated by *Linnæus*, which include under them about eight hundred different species *.



* Vide System. Naturæ, p. 541, et seq.

## Genus I.—*Scarabæus. The Beetle.*

Formerly, the name *ſcarabæus* was applied by naturaliſts to all inſects whoſe wings are covered by a cruſtaceous elytra; *Linnæus*, however, has diſcriminated theſe animals, and confined that term to this ſingle genus. The tribe of *ſcarabæi* are characteriſed by the antennæ, which terminate in a club, and are divided longitudinally into different plates or *lamiuæ*. The ſecond joints of the foremoſt pair of legs, in moſt ſubjects, are dentated *.

The *larvæ* or caterpillars of the greater part of this genus lead a ſedentary life under ground; reſiding moſt frequently in earth, while in a ſtate of fermentation by a large quantity of manure. Pure dung is the favourite food of many; and it is in its immediate vicinity that they chiefly delight to dwell. The cockchafer, the moſt common of all the beetle tribe, is produced from the ova of the female depoſited under ground, where it remains during the whole of its larva ſtate, devouring the roots of plants. In this deſtructive occupation the garden beetle, and all the hairy ſcarabæi are employed, till the period of their emancipation arrive, when they take wing, and, forſaking the roots, betake themſelves to the leaves of plants †. No calculation can aſcertain the miſchiefs produced by theſe animals, in counteracting the labours

* Syſt. Nat. ubi ſupra. † Barbut's Genera Inſectorum, p. 14.

Plate I.

## *Order I.*

### *Genus I.*
### Scarabæi. Beetles.

labours of the huſbandman: The more induſtrious he has been, and the richer his fields are, the more is he expoſed to their unwelcome viſitations. Thoſe which have obtained the name of *pilularii* delight in the filthieſt matter; and they have obtained that appellation from thoſe round balls of excrement which they form, in order to depoſit their eggs. Happily for the ſcanty productions of theſe northern climates, only a ſmall proportion of theſe nauſeous and deſtructive inſects are produced there: fewer, perhaps, are found in *Britain* than in the correſponding latitudes upon the continent.

Of the *ſcarabæi*, properly ſo called, there are three diſtinct families: In the firſt, the thorax is armed with horns; the ſecond has horns upon the head, and is unarmed in the thorax; in the third, both the head and thorax are without horns. Some of the inſects belonging to each of theſe families are *ſcutellati*, or furniſhed with that part called the eſcutcheon, while others belonging to each of them are without it. Our enumeration ſhall comprehend a ſpecies belonging to each of theſe families.

### *The Bull-comber* *.

THIS ſpecies is not very frequent in *Britain*; and is of a very ſingular conformation. The body is broad and ſhort; the elytra have longitudinal ſtreaks that diſappear



* Scarabæus Typhæus, Lin. Syſt.

gradually as they proceed along its ſides; the head projects forward, and the antennæ are very apparent. The colour of this inſect is black, except the inferior parts of the body, which are partially covered with a few vibriſſæ of a brown colour. What particularly diſtinguiſhes the typhæus is the peculiar form of the thorax; the two lateral points of which project beyond the head, having a ſmall protuberance upon the ſide, whilſt the middle point is ſhorter and ſomewhat raiſed. Theſe long projecting horns ſeem given to the inſect as offenſive weapons, although it is incapable of uſing them: It is not always that the members of this tribe of beings are applied to the purpoſes that ſeem moſt obvious and natural to the obſerver.

The reſemblance which theſe thoracic horns bear to the long ſpears carried by the ſoldiers of the *Macedonian* phalanx, has occaſioned the name of phalangiſt, which the *French* naturaliſts apply to this inſect. The larva of the typhæus is moſt commonly found in cow dung, where the grown animal is alſo frequently to be ſeen, both for the purpoſe of collecting food and depoſiting its eggs.

## *The Dung-beetle* *.

THIS ſcarabæus is remarkable for chooſing the moſt filthy reſidence, heaps of dung and excrementitious matter. There

* Scarabæus pilularis, Lin. Syſt.

There are ſeveral other ſpecies nearly reſembling it, in the impurity of its habits, as well as its external form, viz. the blue ſcarabæus, with the elytra and back ſmooth, and the head armed with a rhomboidal helmet prominent at the top †: The ſcarabæus of an azure colour on the head and thorax, black legs, and pale coloured elytra ‡: The ſcarabæus of an oval figure, and black colour; the body ſmooth, and the elytra ſtriated: And the ſcarabæus, whoſe head and thorax are black and without hairs, the legs pale ||.

Theſe and many other pilular beetles are enumerated in the fauna ſwecica of *Linnæus*; their ſize and form are not very different, while they are characteriſed by the ſame manners: They prowl continually amid every kind of filth, ſome of them having the ſame nauſeous ſmell with the impure ſubſtances which they devour.

The dung-beetle, which is here ſelected for deſcription, is ſmooth and of a black colour above, ſome mixed with green; on the lower ſide there are a few ſtraggling vibriſſæ. The head reſembles a hood, raiſed in the middle, and projecting at the edges: The jaws extend beyond the head. The thorax has a groove in the middle; its circumference is marginated, and its figure is round and ſmooth. The elytra are ornamented with a great number of longitudinal ſtreaks: underneath the colours are various and brilliant, conſiſting of different ſhades of blue and green. There is obſervable on the anterior thighs, a ſpot formed by ſome red hairs, which, however, in ſome ſubjects is wanting. The tarſi appear weak

† Syſteme Naturale du Regne Animal, Ord. i. gen. 1. ſpec. 14.
‡ Idem ibidem, ſpec. 15. || Rai, Inſecta, p. 106.

weak and ſlender in proportion to the thighs, and this is uniformly the caſe with all the feet *.

## *The Golden-beetle* †.

THE laſt ſpecies of the beetle is deemed the moſt beautiful of the *Engliſh* inſects. The whole body is of a gloſſy green, tinged with yellow; underneath, theſe colours partake of a ſhade of red, which ſome naturaliſts have compared to leather, others to finely poliſhed copper ‡. In the brilliancy of its hues it rivals the emerald, and has ſometimes been diſtinguiſhed by that name.

The ſcarabæus in its vermicular ſtate remains on the ſurface of the ground, or covered to a little depth with the mould; there it preys on the roots of tender plants. After it is transformed into a winged inſect it chiefly delights in the flowers of the roſe and piony: It is conſequently an inhabitant of the gardens, where its tranſient beauty is reckoned a ſmall compenſation for the miſchief of which it is guilty §. In the impure abode of the dung-beetle, that animal may be leſs pleaſing to the ſpectator; but in return it is productive of leſs harm, and is leſs expoſed to injury in a dwelling, of which it remains the unenvied poſſeſſor.

* Barbut. Genera Inſector, p. 13.

† Scarabæus auralus, Lin. Syſt.

‡ Vide Regne Animale, Tom. ii. p. 8. § Idem ubi ſupra.

## Genus II.—*Lucanus.*

The animals of this tribe are the largeſt *Britiſh* inſects; They are diſtinguiſhed by the antennæ, which terminate in a knob, flattened on one ſide, and divided into a number of pectinated *laminæ*. The jaws are extended beyond the head, incurvated, and beſet with teeth *.

The lucani feed upon the liquor that exudes from oaks, which they ſuck with their tongues. The females depoſite their eggs in the trunks of decayed trees, ſuch as the oak and the aſh. The larvæ or grubs lodge under the bark or in the hollow of old trees, which they gnaw and reduce into a fine powder, and there transform themſelves into chryſalides. They are found all over the iſland of *Great Britain*, but moſt frequently in *Kent* and *Suſſex* †. With the noxious effects of theſe animals on growing timber we are not acquainted; but notwithſtanding their enormous ſize, it is probable that they are far leſs deſtructive than thoſe that prey upon the roots of corn.

* Syſt. Nat. p. 559. † Barbut Gen Inſect. p. 17.

## *The Stag-beetle* *.

This beetle is readily diſtinguiſhed by its ſuperior magnitude, which entitles it to the firſt rank among the inſect tribes: It is however characteriſed by another peculiarity no leſs ſingular, and that is the large moveable maxillæ, reſembling in form the horns of a ſtag. Theſe inſtruments are broad and flat, projecting from the head nearly one third of the animal's length. They have in the middle, towards the inner part, a ſmall branch, and at their extremity are forked. Their ſimilarity in ſhape to the horns of the animal above mentioned, has ſtruck every naturaliſt, and has, with equal propriety, procured for the inſect the appellation of the *flying ſtag* †.

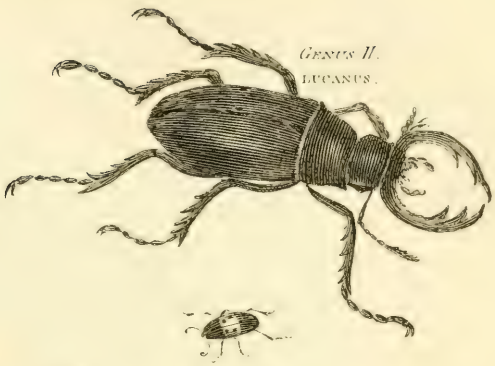
An inſect of ſuch an uncommon ſize as the ſtag-beetle, and of ſuch ſingular conformation, has attracted the notice of all the entymologiſts. The female is diſtinguiſhed by the ſize of her horns, which are not above half the ſize of thoſe of the male; both, however, are armed in the anterior ſide with ſmall teeth, throughout the whole of their length; and both are ſometimes as red as coral, which gives theſe animals a very beautiful appearance.

The head that ſupports theſe romantic horns, is broad, ſhort, and irregular; and the thorax, which intervenes between

* Lucanus Cervus, Lin. Syſt.

† Cervus volans. Vide Mouffet, p. 148. Aldrovand. inſect. p. 151. Imperati, p. 169, and Charleton, p. 46.

Plate II.



*Genus II.*
LUCANUS.



*Gen. V.*
HISTER.

*Gen. III.*
DERMESTES.

*Gen. IV.*
PTINI.

*Gen. VII.* BYRRHUS.

*Gen. VI.*
GYRINUS.

*Gen. XI.*
CHRYSOMELA.

*Gen. IX.*
CASSIDA.

*Gen. VIII.*
SILPHA.

*Gen. XIII.*
BRUCHUS.

*Gen. XII.*
HISPA.

*Gen. X*
COCCINELLA

between it and the body, is narrower than either, and marginated around. The elytra of this beetle are very plain, being unadorned with either ſtreaks or lines. The colour of the whole animal is uniformly of a deep brown.

The reſidence of theſe animals is commonly the oak; in ſome parts of the country they are but rarely to be met with; and though the largeſt of all the coleopterous in this part of the world, they are much ſmaller than thoſe of the ſame ſpecies, in countries where woods are more extenſive, and the climate is warmer. In theſe they acquire an amazing ſtrength and vigour; and the maxillæ, whoſe ordinary office is to tear the bark of trees, are occaſionally converted into offenſive weapons, which are carefully avoided by ſuch as have experienced the ſeverity of their bite.

## *The Parallelipiped Beetle* *.

THE body of this ſpecies is black; the horns ſmaller than thoſe of the preceding, which in other reſpects it nearly reſembles, and the body is oblong, and of that ſhape expreſſed by the *Linnæan* name, which we have borrowed †. It frequents the meadow grounds, and its



* Lucanus parallelipipedus, Lin. Syſt. Scarabæus platyceros, Rai.

† Rai Inſect. p. 75.

habits are therefore probably different from thoſe of the ſtag; but very little relating to its economy is known.

*Linnæus* enumerates five other ſpecies of the lucanæ viz. the capreolus, the tridentatus, the interruptus, the carinatus, and the caraboides: Of theſe the bidentatus is diſtinguiſhed by three teeth, with which the thorax is armed on each ſide. The maxillæ, like thoſe of the laſt ſpecies, are in the form of a creſcent, prominent, and indented on the inner ſide. It is a *Swediſh* inſect, not much inferior in ſize to thoſe already deſcribed, and bears a ſtrong reſemblance to them in many particulars of its economy.

## GENUS III.—*Dermeſtes.*

WE are now come to a tribe of beetles, much inferior in ſize to thoſe already mentioned; but of ſuperior beauty. Many of the inſects belonging to this genus exhibit a variety of the richeſt colouring that flows even from nature's pencil. They are near neighbours of man, and often troubleſome companions: One ſpecies of the lardarius is deſtructive to meat, and is very difficult to prevent from entering into the repoſitories of the cook. It is a ſtill more unwelcome intruder into the cabinets of the curious; being very deſtructive to birds, inſects, and other ſubjects of natural hiſtory, in a ſtate of preſervation. Arſenic is the moſt certain preventative againſt its depredations there. Many ſpecies of this family, as well as their larvæ, inhabit dried ſkins, the bark of trees, rotten wood, ſeeds, flowers, and the carcaſes of dead animals.

The antennæ of the inſects of this tribe principally exhibit their generic characters. They terminate in a perfoliated club of an oval form, and divided into different plates or leaves, which ſeem to be united together by a ſmall ſtalk. The thorax is of a convex form, and ſlightly margined: the head is bent inward, and, as it were, concealed in the thorax *.

* Syſtema Nat. p. 561.

## *The Domeſtic Dermeſtes* *.

THE form of this inſect is oblong, and almoſt cylindrical: The elytra are ſtriated; the thorax thick and gibbous. There are many varieties in the ſpecies, differing conſiderably both in ſize and colour; ſome being found of a dark brown, and others of a much lighter hue. When touched, it is ſtruck with ſuch an apprehenſion of danger, that it inſtantly draws back its head under the thorax, and its feet under the abdomen, remaining motionleſs in that poſition till the danger is over †.

Of all inſects this is the moſt deſtructive to wooden furniture, where it is found in vaſt numbers, their larva ſtate perforating it into thoſe ſmall round holes that appear on the external ſurface, while the inner parts are reduced to powder. There are few kinds of wood ſo hard as to be proof againſt the attacks of theſe animals, after they have remained long enough out to be drained of their natural juices. It does not ſeem to be aſcertained how the eggs of this animal came at firſt to be depoſited in timber: it would ſeem, that the winged animal which produces them, has the power of perforating cells for their reception; but it is evident, that the young in their larva ſtate have a much greater degree of voracity, than the perfect animals, which are ſeldom found devouring

* Dermeſtes domeſticus, Lin. Syſt. † Barbut genera inſect.

ing furniture, in compariſon with thoſe worms which no invention has been able to deſtroy. The acrid varniſh, which is now extracted in ſuch abundance from coal, promiſes to be the moſt effectual remedy againſt their encroachments *.

## *Dermeſtes Lardarius* †.

This inſect is of a black colour, and eaſily diſtinguiſhed by a large tranſverſe ſtripe covering the anterior part of the elytra, which is of a cinereous hue. The ſtripe receives this pale colour from a number of ſmall gray hairs which grow upon it; it is irregular at the edges, and interſected through the middle by a ſmall tranſverſe ſtreak of black ſpots, three in number, on each ſide of the elytra; the middle ſpot ſomewhat lower than the reſt, gives the black ſtreak a ſerpentine or undulating form ‡.

This animal feeds upon cadaverous carcaſes, and meat verging to a ſtate of putrefaction: It makes its way into the muſæum, and is ſeen among preparations, in numbers more than ſufficient to gratify the curioſity of the poſſeſſor. In fact, it is among the greateſt enemies of his labours: and in the larva ſtate, makes the greateſt havock among the collections of inſects §. It then aſ-

ſumes

* Vide Chap. i. ſect. 1.

† Scarabé Diſſequeur noir, Regne Anim.

‡ Barbut gen. inſectorum. § Regne Animale, Ord. 1. gen. 2.

ſumes the form of a hairy oblong worm, which is divided into ſegments alternately of a dark and light colour. In that form it is often found deeply penetrating into old bacon, which it renders uſeleſs.

The inſects of this genus are extremely numerous; *Linnæus* has enumerated thirty ſpecies, and is probably far from having completed the catalogue. They are of ſizes and colours too various even for the pencil to deſcribe: In their manners, however, there is a ſtrong reſemblance; moſt of them inhabiting dung or putrid fleſh. The beautiful tints diſplayed by ſome, overcome our averſion to their impure habits: The violet dermeſtes exhibits the moſt brilliant ſhades of that colour *. The thorax is covered with greeniſh hairs; the legs black, forming upon the whole a pleaſing object, if we could forget that its reſidence, both in the larva and perfect ſtate, is in the bodies of dead animals. 2

* Syſt. Nat. Ord. 1. gen. iii. ſpec. 13.

## GENUS IV.—*Ptinus.*

THIS genus is characterised by its filiform antennæ, the extreme articulations of which are longer than those nearer the animal. The thorax is without a margin, rounded, and affords a receptacle for the head, into which the insect frequently draws it *. There are probably many varieties of this tribe which, from their extreme minuteness, escape observation: *Linnæus* has enumerated six different species, whose habits nearly resemble those animals last described. They attack household furniture, cloths, furs, and particularly dried animals in a state of preservation. Some of them when caught, have the artifice to counterfeit death. They draw in the head and limbs, and remain till the danger is over in a state of inaction, from which nothing but the application of heat can rouse them.

In order to deposite their ova they retire among hay, dried leaves, and other substances of a similar nature. from these retreats their larvæ issue, and penetrate rotten wood, and decayed household furniture †.

The ptinus pectinicornis is the first species enumerated in the system of nature; it is produced from a small worm that lodges in the rotten parts of the bark of trees, where it makes a deep hole. The worm is there trans-



* Idem, gen. 4. † Barbut's Gen. Insect. p. 23.

formed into a winged insect, which has obtained its name from the form of the antennæ, being pectinated on one side. The elytra and thorax are of a deep clay-coloured brown; the antennæ and legs are of a paler shade of the same colour.

## Genus V.—*Hiſter.*

There are ſix ſpecies enumerated under this genus, all varying in ſize, but uniformly of a dark colour: in ſome the elytra are ſtriated, in others ſpotted; while ſome are ſmooth and uniform in their colour. The larvæ, as well as the winged inſects of this genus, reſide moſt frequently in the dung of horſes and cows, and often upon ſand. The general characters in which they all reſemble each other, are drawn from the ſhape of the antennæ; the laſt articulation of which is larger than the others, and terminates in a ſolid knob; while the firſt articulation is compreſſed and incurvated. The mouth is forcipated; the head drawn back within the body; and the fore-legs are dentated *.

The hiſter unicolor is one of the moſt beautiful inſects belonging to this tribe: The body is black, poliſhed, and brilliant. The figure of the animal is almoſt ſquare; the thorax large, and highly poliſhed, having a ſlight margin that bounds its circumference. The anterior part is formed with a ſlope, into which the head is withdrawn, ſo completely, that it is only perceptible by the projection of the maxillæ. From this ſituation of the head, the inſects of this genus often ſeem altogether deprived of that part. The elytra end abruptly, as if cut away by the middle, before they reach the whole length of the abdomen: They are ſmooth, having only a few ſtriæ on the outer ſide, that are ſcarcely perceptible †.

* Syſtema Nat. ord. 1. gen. 5. † Earbut Genera Inſectorum.

## GENUS VI.—*Gerinus.*

THERE are only two ſpecies belonging to this family of inſects; the Natator and the Americanus; both eaſily diſtinguiſhed by their form, as well as their manners. The antennæ are clavated, ſtiff, and ſhorter than the head: The hinder legs are alſo ſhort, flat, and very broad. Theſe animals are ſaid to have four eyes *, two on the upper and two on the under ſide of the head; they appear in fact, on both ſides of the head, but their number is only two.

The gerinus natator has an *Engliſh* name, being known in this country by that of the water-flea. It is that ſmall animal which is ſeen deſcribing circles on the ſurface of the water, by running on it with great ſwiftneſs. When an attempt is made to take it, it plunges below and eludes the graſp. The larvæ are ſaid to be found together with thoſe of the elytiſcus, an animal conſiderably larger.

The colour of the water-flea is a reſplendent black, with a ſhade of brown: The elytra are adorned with beautiful ſtriæ, conſiſting of a number of points ſo minute, as hardly to be obſerved without the aſſiſtance of a microſcope. On the hinder part of the margins of the elytra are ſeen, by the ſame means, ſmall protuberances,

* Syſtema Naturæ.

rances, born upon pedicles, and ſo deciduous, that the ſmalleſt friction ſweeps them away *. The feet of this inſect are of a yellowiſh brown, and the hinder pair ſo ſhort, that in certain poſitions the animal ſeems to have but two.

* Barbut Genera Inſectorum.

## Genus VII.—*Byrrhus.*

This tribe when in its larva ſtate, reſembles the worms of the dermeſtes; like them alſo they are extremely voracious, and are but too well known to thoſe who are employed in collecting the ſubjects of natural hiſtory. Their antennæ, when they arrive at the winged ſtate, are clavated, terminating in a capitulum or knob of a ſolid ſubſtance and oval ſhape.

The byrrhus verbaſci of *Linnæus* is of this genus, whoſe elytra are ſo thickly ſet with ſmall ſcales, that the black colour of them is no where to be ſeen. Theſe ſcales were of a white colour in the ſubject we examined, and ſo arranged, that they formed three undulating ſtripes acroſs the elytra; between theſe ſtripes there were others of a ſimilar form, but of a reddiſh brown. The inſect is ſometimes to be found ſtripped of this ſcaly covering, which ſo diſfigures it, that it can hardly be recogniſed for the ſame animal.

## GENUS VIII.—*Silpha.*

THE inſects belonging to this claſs are very voracious of carrion, upon which they depoſite their ova in vaſt numbers. Thirty-five different ſpecies of this fertile race have already been diſcovered; and it is probable that many have hitherto eſcaped all notice from naturaliſts. The antennæ grow gradually thick towards their extremeties; the elytra are marginated; the head is prominent; and the thorax flattened, and ſurrounded with a border.

The different ſpecies of ſilphæ vary but little from each other, either in form or colour: In *Britain*, many of them are ſeen early in the ſpring, under the looſe bark of trees. The ſilpha veſpillo is one of the moſt remarkable of this genus, from which it differs conſiderably in the form of its antennæ. They have at their extremity a reddiſh knob, formed by four ſmall plates ſtrung through the middle, one upon the other; the laſt being thicker, forms a ſmall ſharp pointed knob. The head, thorax, and body are black, charged with a few hairs of a yellowiſh hue. The thorax is of a rounded form, marked by ſeveral protuberances, and has the circumference terminated by a broad, flat, margin. The elytra are ſhort, and as it were, cut acroſs, leaving about one third of the body uncovered. Their colour is black, and variegated with two yellow tranſverſe ſtripes.

## Genus IX.— *Caſſida.*

In this tribe the antennæ are nearly filiform, thickening a little towards their extremities: The elytra have a broad margin, and the head is entirely concealed under the thorax, which is flat, and forms a kind of ſhield to it*; a peculiarity from whence this genus takes its name.

The caſſidæ that are found in *Britain* have, in their larva ſtate, two prongs projecting from the extremity of the abdomen, with which they form a kind of umbrella of their own excrements, to ſhelter them from the ſun and rain. When the umbrella becomes unfit for that purpoſe, it exchanges it for another, which is fabricated of the ſame materials†. Theſe inſects, which in their larva ſtate are diſtinguiſhed by manners as diſguſting as thoſe of the *Hottentots*, are afterwards transformed into the moſt elegant of the beetle tribe. Before they undergo their laſt change, they caſt the ſkin ſeveral times; their food all the while being different kinds of thiſtles, and verticillated plants.

There are thirty-one ſpecies of the caſſidæ already deſcribed; of theſe the green oval ſhaped caſſida ‡ is the moſt remarkable for its beauty. Above, the elytra are wholly of a green colour, variegated with ſmall ſtriæ, and projecting from the body like the ſhell of a tortoiſe; underneath, the body is entirely black, and ſupported by pale coloured feet: It inhabits the gardens and fields.

* Syſt. Nat. p. 574. † Reaumur, Tome III. Mem. vii.
‡ Rai Inſ. p. 107.

## Genus X.—*Coccinella.*

The coccinellæ are generally diſtinguiſhed by ſubclavated antennæ; the palpi are alſo club-formed, the laſt articulation being ſhaped ſomewhat like a heart. The body is hemiſpherical, the thorax and elytra margined *. They are the moſt brilliant inſects of this order; ſome ſcarlet, others yellow, pale green; and theſe ſplendid colours are finely variegated with ſpots.

When the females of this tribe have been impregnated, they depoſite their eggs upon the leaves of trees; and from them there are produced larvæ that are great devourers of plant lice. Their chryſalid ſtate continues for about a fortnight, when they are ſeen attached to a leaf by the hinder part; their bodies bent and ſwollen. Their wings, after burſting the covering, ſoon become hard, and change from their pale colour to the red or ſcarlet, according to the particular ſpecies. Theſe inſects are hardly ever capable of flight; their motions appear rather like jumping than flying.

The lady-bird of the *Engliſh* is a beautiful ſpecies belonging to the tribe of coccinellæ; the elytra are red, bordering upon yellow, and adorned with two black ſpots, one on the middle of each. The colour of the under parts is black. This ſpecies is found on the leaves



* Syſtema Nat. p. 579.

of trees; and in its larva ſtate is a devourer of plant lice *. The different ſpecies of theſe animals are known principally by their colour, and the number of ſpots with which their wings are adorned. *Linnæus* has enumerated no leſs than forty-nine kinds.

* Vide Rai Inſ. p. 86.

## Genus XI.—*Chryſomela.*

From the variety of different colours with which the inſects of this tribe are adorned, they have been called *chryſomelæ*. There are no leſs than an hundred and twenty-two different ſpecies deſcribed by naturaliſts, diſtinguiſhable by their ſize, colour, and manners. They all agree, however, in having the antennæ moniliform, and increaſing in thickneſs towards the ends: Neither the thorax nor elytra are margined *.

The chryſomelæ are to be found almoſt every where; ſome frequent the open fields; others the woods, and many the gardens. Their larvæ prey upon the leaves of trees, rejecting the fibrous parts; ſome of them deſtroy the graſs while in that ſtate; and there is in *Sweden* a particular ſpecies, ſaid to be guilty of very extenſive depredations on the paſture grounds. This inſect, when it has reached its winged ſtate, is of a fine gloſſy green, mixed with a ſhade of blue; the whole diſſeminated with a number of ſmall ſpots, which form irregular ſtriæ †.

Chryſomela ſanguinolenta, has the elytra of a deep black, interſperſed with ſmall ſpots, which gives them the appearance of ſhagreen: Their margins, and the wings which they cover, are marked all along with a broad band of light red, which reſembles ſtreams of blood; the belly, thorax, and head, are of a blue colour.



* Syſt. Nat. p. 586. † Barbut, p. 40.

Chryſomela cruciata †. This ſingular ſpecies has the elytra yellow, and marked with two black lines, reſembling a croſs; the head of a dark blue, the thorax brown, narrow, and cylindrical. This ſpecies is frequent at *Hamburg*, where it devours the aſparagus, and is ſuppoſed by the gardeners to have been tranſported from *Ruſſia* along with that plant ‡.

† Friſch, p. 27. ‡ Regne Animale, p. 26.

## GENUS XII.—*Hiſpa.*

ONLY two ſpecies of theſe inſects are found in *Europe*; two others are enumerated by *Linnæus*, which are not indigenous in this quarter of the globe. They have the antennæ formed like ſpindles, growing gradually thicker from each extremity to the middle: their inſertion is between the eyes; the thorax and elytra of this tribe form their moſt diſtinguiſhing character; both being covered with protuberances like ſpines *.

The hiſpa atra is of a deep black; the upper part of the body entirely covered with ſtrong ſpines, ſomewhat like the ſhell of a cheſnut; the elytra are alſo ſet thick with ſmall vibriſcæ, which makes this very ſmall inſect prove a hedgehog in miniature †.

* Syſt. Nat. p. 603. † Barbut, p. 43.

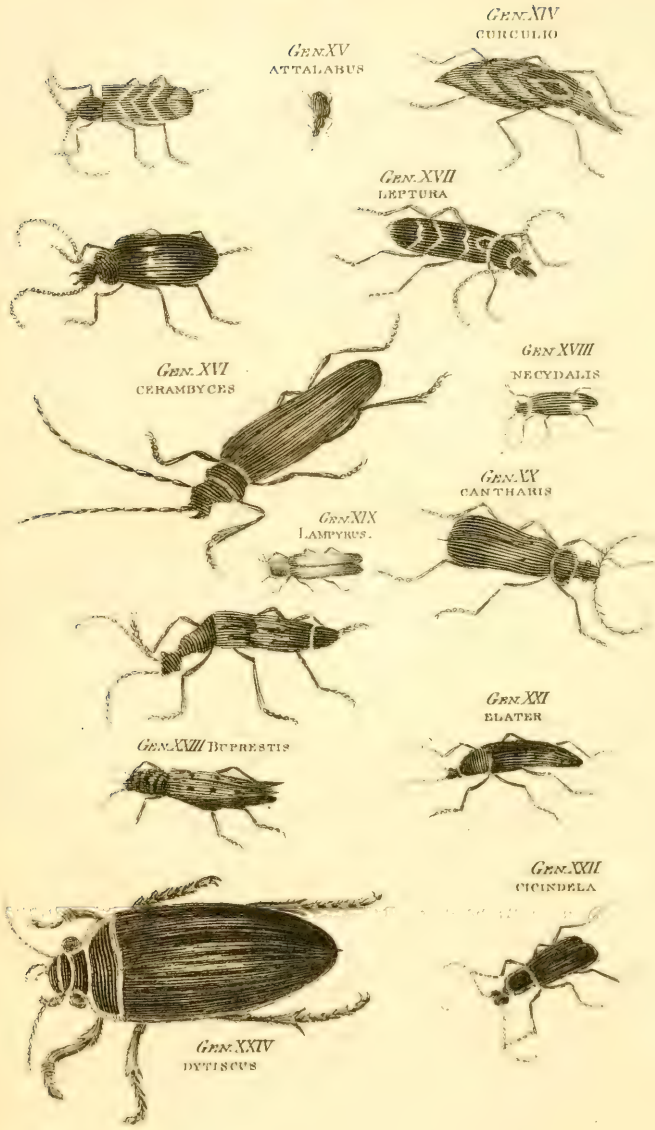
## Genus XIII.—*Bruchus*.

This family of insects is superior in size to the last, and more diversified: It contains seven species, having club-formed antennæ; four palpi placed at the extremity of a short rostrum *.

The bruchus of the pea blossom frequents that flower; is covered with ash-coloured down, forming cloudy spots upon the thorax and elytra; the latter are so short, that they leave a great part of the abdomen exposed, and thickly covered with longitudinal streaks.

* Systema Nat. p. 607.

Plate III


Gen. XIV
CURCULIO
Gen. XV
ATTALABUS
Gen. XVII
LEPTURA
Gen. XVI
CERAMBYCES
Gen. XVIII
NECYDALIS
Gen. XV
CANTHARIS
Gen. XIX
LAMPYRIS.
Gen. XXI
ELATER
Gen. XXIII BUPRESTIS
Gen. XXII
CICINDELA
Gen. XXIV
DYTISCUS

## Genus XIV.—*Curculio.*

These infects are in ſome parts called *weeſils*: Near an hundred different kinds are enumerated in the Syſtem of Nature, a fifth part of which are found in *Scotland.* The antennæ are ſubclavated, and ſituated in a projected roſtrum, of a horny ſubſtance.

As ſome of the birds who are ſupported by the fruits of man's induſtry repay their benefactors with a ſong, ſo the inſects of this genus make ſome compenſation for the ravages they commit, by the enchanting richneſs and variety of their colours. Upon them nature ſeems to have profuſely laviſhed the moſt refulgent and vivid tints which dazzle the eye. Often, however, the curculiones peculiar to our country are ſo diminutive in ſize, that we are only admitted to ſurvey their beauties by means of the microſcope.

In their larva ſtate, the animals of this genus are neither ſo inoffenſive nor ſo beautiful, as to entitle them to the favour of man. They penetrate into the grains of corn, while yet of ſmall ſize, and in proportion as they grow, they increaſe the boundaries of their habitation, by eating out the heart of the grain. As the number of theſe inſects is great, the miſchief they occaſion in granaries and corn lofts is often very conſiderable. After lying for ſome time, the grain which they frequent is entirely conſumed to the huſks; and however ſound it may externally

ternally appear, it is no ſooner expoſed to the wind, than it blows before it like chaff.

It is with the huſks of grain, after they have ate the ſubſtance, that theſe animals are transformed into chryſalids; and when ready to come forth winged, they perforate their manſion, to make room for their eſcape. Beans, peaſe, oats, and other kinds of grain, afford food and a retreat to this tribe; many of which alſo perforate plants, and dwell in the interior parts; ſome of them mine into the leaves of trees, devouring the parenchyma that lies between the outward pellicules.

The green curculio *. This ſpecies is of a bluiſh green, ſhining with a fine reſplendent ſhade of gold, like the neck of a pigeon: The head, thorax, abdomen, and feet, are all of this beautiful colour; the antennæ are black, having the laſt articulation longer than the reſt.

* Pelivert. Gaza, p. 77.

## Genus XV.—*Attelabus.*

This tribe very much reſembles the laſt, but is inferior in ſize and beauty: The animals which compoſe it have the head inclined, and gradually tapering towards the thorax; the antennæ increaſe in thickneſs as they approach the extremity *.

Attelabus curculionoides has obtained its name from its reſembling the curculio; the antennæ are ſhort, fixed on the point of the head, which is of a triangular ſhape, having the ſharp angle joined to the thorax; the head, part of the thorax, and belly, are black; the reſt of the inſect is of a fine red.



* Syſtema Nat. p. 619.

## Genus XVI.—*Cerambyx. The Capricorn.*

The tribe of capricorn beetles owe their original to larvæ reſembling ſoft ſlender worms, whoſe heads are ſcaly, and who are provided with ſix hard legs. Theſe larvæ, which produce a race of the moſt beautiful inſects, are in general white, and are found in the inner part of trees, which they perforate for a double purpoſe, that of obtaining food and a retreat, while transformed into chryſalids. It is from theſe cavities that the winged capricorn is ſeen iſſuing, as ſoon as it has completed its laſt change; and in this act it is eaſily caught. Many of theſe inſects emit a ſtrong ſmell, which is felt at a conſiderable diſtance; and when laid hold of, they utter a cry, occaſioned, as is ſuppoſed, by the friction of the thorax and abdomen.

Cerambyx viridi-cæruleſcens *. This ſpecies is green, with a mixture of azure blue; the antennæ are as long as the body; each ſide of the thorax is furniſhed with a ſharp protuberance; the wings are black, and the feet of a reſplendent blue. It frequents the leaves of the willow, and, when approached, emits an agreeable flavour, like that of the roſe †.

* Fauna Swecica & Liſter, p. 384. † Regne Animale, p. 35.

## Genus XVII.—*Leptura. The Wood Beetle.*

The antennæ of theſe inſects are ſetaceous; the elytra diminiſh in breadth towards their extremity; and the thorax is round and ſlender. The larvæ of the wood beetles are found, like thoſe of the laſt genus, in the perforated trunks of trees, and, like them, they devour the pulveriſed wood when digging their retreat.

Leptura arcuata. This is one of the moſt beautiful of inſects; when viewed with a microſcope, it appears like velvet inlaid with precious ſtones; and if expoſed to the rays of the ſun, it ſhines with infinite ſplendour. The ground colour of this animal is a velvety black; the elytra are variegated with tranſverſe bars of a bright flame colour, formed by ſtreaks of down, of a refulgent yellow *.



* Barbut, p. 57.

## Genus XVIII.—*Necydalis. The Carrion Eater.*

Of this genus there are eleven ſpecies, which have obtained their *Engliſh* name from their ſuppoſed predilection for carrion. In their winged ſtate, they generally frequent the woods; their reſidence and habits, while larvæ, are wholly unknown. The generic characters of theſe inſects are, the ſetaceous form of the antennæ, and the ſhape of the elytra, which are either ſhorter or narrower than the abdomen †.

The firſt inſect of this family enumerated by the *Swediſh* naturaliſt is the larger carrion eater, which is diſtinguiſhed by its large and prominent eyes: The antennæ are raiſed upright as far as the firſt articulation, after which they are bent, and turned aſide. In ſome individuals, the thorax is black, in others yellow; the elytra are generally black, lighter towards the middle, which contains a lemon-coloured ſpot.

† Syſtema Nat. p. 641.

## Genus XIX.—*Lampyris. The Fire Fly.*

These insects are characterised by filiform antennæ, flexible elytra, a round flattened thorax, surrounding and concealing the head; the females are, in most species, without wings †. It is the female of one species of these insects that is in this country termed the glow-worm, from that phosphorescent light which it emits during night. Two or three of these animals inclosed in a glass vase, will give a light sufficient to enable a person to read in the darkest night.

This singular phenomenon is observed most frequently in the month of June, when the animal is in motion. The female can withdraw or display this light at pleasure, by contracting or unfolding her body; her purpose in shewing it is said to be in order to attract the male. When crushed with the hand, this luminous substance of the glow-worm adheres to it, and continues to shine till it is dried up.

The noctiluca, or glow-worm, in its insect form, possesses elytra, and wings under them, longer than the body. The head and antennæ are black; the former entirely concealed by the broad plate of the thorax. The four last rings of the abdomen, which emit the light, are in the male not so bright as those of the female, and are nearly destitute of that luminating quality which renders her so remarkable ‡.

† Syst. Nat. p. 643. ‡ Barbut, p. 62.

## Genus XX.—*Cantharis.*

The insects of this family are numerous, and distinguished into twenty-seven different kinds. From the similarity of the name, some have supposed them the same with the cantharides imported from *Spain*, whose virtues are so well known in medicine; that insect, however, belongs to a different genus. The cantharis frequents flowers; its larva resembles that of the cerambyx already described.

All the insects of this tribe have setaceous antennæ, the elytra flexible, and the thorax margined, and shorter than the head. Like the preceding genus, they have papillæ upon the sides of the abdomen.

Cantharides æneo-viridis †. This insect is of a kind of brass green; on each side of the thorax is a small nipple, of a saffron-colour, with three tips. The thorax and elytra are of a deep green, the latter terminating in a red spot. Beneath, the insect is of the colour of brass, and red under the wings ‡.

† Rai Inf. p. 101. ‡ Regne Animale, p. 69.

## Genus XXI.—*Elater. The Skipper.*

The inſects of this genus are diſtinguiſhed by ſetaceous antennæ, but more particularly by an elaſtic ſpine which ſprings from the under ſide of the thorax, near the extremity. By means of this ſpring, theſe animals, when turned upon the back, are capable of jumping into the air, and recovering their poſition.

In the ſtate of larvæ, the inſects of this genus inhabit the trunks of decayed trees, and are there metamorphoſed into the winged form. Their reſidence is then changed, and they are ſeen in various haunts, flowers, thickets, or open fields.

The cheſnut-coloured elater †. This inſect is found both in the corn and paſture fields. The antennæ are branchy, and the tips of the elytra black; the reſt of a pale fleſh-colour; the thorax is covered with a fine aſh-coloured down ‡.

† Liſter Loqu. p. 387. ‡ Regne Animale, p. 64.

## Genus XXII.—*Cicindela. The Sparkler.*

The porrected jaws afford an eaſy mark to diſcriminate the inſects of this genus; they are both armed with teeth; the eyes of theſe animals form another ſtriking peculiarity, being ſingularly prominent; the thorax is round, and margined †.

Cicindela campeſtris. This inſect is one of the moſt beautiful which this country affords. The whole upper parts of the body are green, tinged with blue; underneath is a mixture of yellow, red, and copper. The elytra are delicately marked, each with ſmall white ſpots. The inſect, and its larvæ, are found in ſandy dry ſituations; the latter reſemble ſoft whitiſh worms, and immerge themſelves into a perpendicular hole in the ſand, with the head at the bottom, ready to catch the inſects that fall into it. Theſe animals are all rapacious, devouring whatever they can overcome ‡.

† Syſtema Nat. p. 657. ‡ Barbut, p. 70.

## Genus XXIII.—*Bupreſtis. The Cow-burner.*

These animals, both in their external figure and manners, nearly reſemble the ſkippers already deſcribed; their colours, however, are far more reſplendent; and, when viewed with a microſcope, their effulgence dazzles the eye. From this circumſtance, they have obtained in *France*, where they are more numerous than in this country, the name of *Richards*.

The characters of this genus are, ſetaceous antennæ; the head drawn back within the thorax; the mouth armed with jaws, and furniſhed with palpi.

Bupreſtis guttata. This elegant ſpecies is found on ſandy ground, below timber that has begun to rot. Its head enters within the thorax, and the elytra are furrowed, and adorned each with four or five ſpots of a bright yellow; the upper ſide of the abdomen is blue *. The larvæ of this and the other ſpecies belonging to this tribe are unknown.



* Regne Animale, p. 58.

## Genus XXIV.—*Dytiſcus. The Diver.*

This genus comprehends twenty-three ſpecies of aquatic inſects, moſtly of a very large ſize; they are diſtinguiſhed by the antennæ, which are either ſetaceous, or terminated by a perfoliated knob; the hind legs are armed with claws, and furniſhed with vibriſſi, that enable the inſect to ſwim *.

The divers have obtained their name from the ſudden eſcape they make from danger, by plunging into water. By day, they frequent the ſtagnated pools, from whence they iſſue in the evening, to make excurſions on the wing. The males have furrowed elytra, while thoſe of the females are plain. The latter, when impregnated, depoſits her eggs in the water, wrapped up in a ſilky cod, of a texture ſufficiently ſtrong to protect them from predatory inſects, eſpecially thoſe of their own kind, which are mutually rapacious. Their larvæ are worms conſiſting of eleven ſegments, diſtinguiſhable by the largeneſs of their heads, and by four filiform antennæ; they devour other water inſects, and even each other. When arrived at their winged ſtate, their bodies are protected by a hard ſcaly coat of mail: If caught unguardedly, they are in that ſtate capable of giving a ſevere bite, as well as of wounding the hand with a ſharp ſpine.

Dyticus

* Syſtema Nat. p. 664.

Dyticus piceus. This is one of the largeſt of the tribe; all over of ſhining black; the antennæ are of the ſhape of clubs, and perfoliated. Their colour, and that of the four palpi, is brown; the head of this inſect is flattened and furniſhed with a pair of formidable jaws.

## Genus XXV.—*Carabus. The Ground Beetle.*

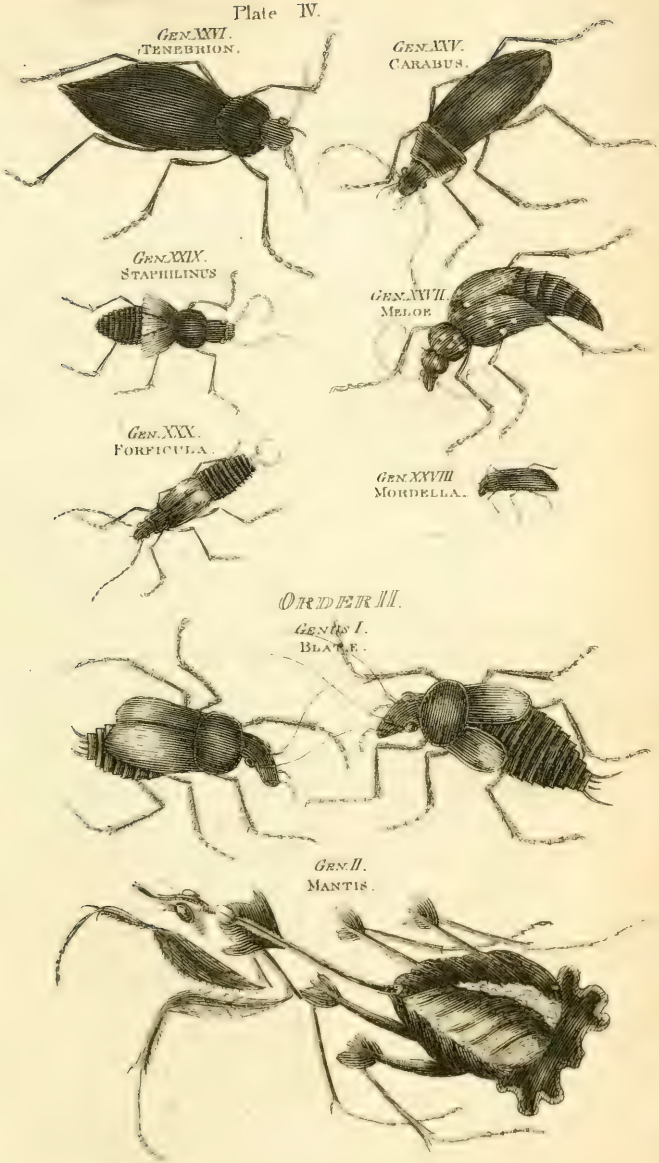
In this family, which contains no leſs than forty-three ſpecies, are found ſome of the largeſt of the *Britiſh* inſects. They are characteriſed by ſetaceous antennæ, and by the ſhape of the thorax, which reſembles a heart; the point cut off and margined. The elytra are likewiſe ſurrounded with a margin *.

In their winged ſtate, the heads of theſe animals are prominent; their mouths, like thoſe of the preceding genus, are armed with jaws, and four palpi. Their eggs are depoſited under ground, or in decayed trees, where the larvæ reſide till they are metamorphoſed. It is during their caterpillar ſtate, that they are prejudicial to gardens, and hence have been ironically called gardeners by the *French* †. It is not, however, vegetable productions alone that they devour: They are the greateſt tyrants to other inſects, and deſtroy indiſcriminately, as many as their ſtrength enables them to overcome.

Carabus violaceus ‡. This ſpecies is of an oblong ſhape; the colour a dark violet: The edges of the thorax and elytra, are violet with a ſhade of purple. The latter have neither dots nor ſtreaks, but are marked with ſtrong longitudinal wrinkles. It is found among rotten wood.

* Syſtema Nat. p. 668.
† Regne Animale, p. 44.
‡ Rai Inſ. p. 96. n. 1.

Plate IV.


GEN.XXVI.
TENEBRION.
GEN.XXV.
CARABUS.
GEN.XXIX.
STAPHILINUS
GEN.XXVII.
MELOE
GEN.XXX.
FORFICULA.
GEN.XXVIII
MORDELLA.
ORDER III.
GENUS I.
BLATTE.
GEN.II.
MANTIS.

## Genus XXVI.—*Tenebrio. The Darkling.*

These insects are commonly of a dark sombre colour: Some have wings under their elytra, while others are apterous; and from this circumstance, they have been divided by naturalists into two sections, containing together thirty-three different species. The larvæ of some species reside among rotten sticks, or rubbish; those of others take up their abode among flour, and different kinds of food. After they have become perfect insects, they enter houses and devour every sort of provision. Their principal resort is to damp cellars, where putrid air and darkness attract them. It is from their precipitately avoiding light, as well as their gloomy appearance, that they derive their generic name.

Tenebrio Mortisager *. This fable animal is found among rubbish and dung in gardens; when it enters houses, as is frequently the case, the credulous believe it the certain forerunner of death. It is entirely of a deep black, without the least lustre: The antennæ are long; the thorax margined; and the elytra wrinkled. This, as well as some other species, is remarkable for emitting a fetid smell †.

* Tenebrio primus Voyage d'Alande. † Charleton exercit. p. 48.

## Genus XXVII.—*Meloe. The Bloſſom Eater.*

In the firſt edition of the Syſtem of Nature, there were only one ſpecies of this genus taken notice of; in the later improvements of that celebrated work, there are ſixteen kinds of theſe animals enumerated; while, perhaps, a ſtill greater number remains to engage the reſearches of future hiſtorians. This ſingular tribe, contains in it the genuine cantharis, or bliſtering fly, and is diſtinguiſhed by having moniliform antennæ, with the laſt articulation of an oval ſhape. In all theſe inſects the head is inflected and gibbous; the thorax round; and the elytra flexible *.

The inſects of this genus are either winged or apterous; in the former, the elytra are ſhort, extending about half the length of the abdomen: In the latter, theſe parts reach the whole length of the body, and conceal under them two ſlender wings: In all of them the antennæ reſemble a necklace, compoſed of a number of ſmall rings; thoſe of the middle larger than thoſe near either extremity.

Meloe proſcarabæus †. This inſect is ſoft to the touch, and of a deep black, with a ſlight ſhade of purple towards the under part of the body. The feet and the antennæ are

* Syſtema Nat. p. 679. † Mouffet Edit. lat. 162.

are of a violet hue. The elytra are coriaceous, and ſeem as if cut through obliquely from the inner to the exterior edges, being thicker at their future than at the ſides. Some naturaliſts have termed this ſpecies the unctuous cantharis, from that fat, oily, and fragrant ſubſtance, which exſudes from the body *. This oleaginous matter enters into the compoſition of ſalve for plague-ſores; and is deemed an excellent antidote againſt the poiſon of the ſcorpion's ſting.

Meloe veſicatorius. This is the ſpecies ſo frequently uſed in pharmacy; an inſect to which man is perhaps more deeply indebted, than to any individual belonging to this claſs of beings. The bliſtering cantharis is about nine lines in length; the colour a refulgent green, mixed with azure. In the ſouthern parts of *Europe* it multiplies exceedingly; ſome of the provinces of *Spain* annually receive a large ſum for thoſe they export to the reſt of *Europe*. They are there ſeen flying in vaſt ſwarms, and alighting upon trees and ſhrubs, whoſe leaves they devour. They are ſaid to prefer the aſh leaf to that of any tree in the foreſt; but whatever leaves they devour, they are uniformly accompanied with a heavy nauſeous ſmell, like that of mice, and thence their haunts are diſcovered by thoſe who go in queſt of them.

In their humid and living ſtate, the odour exhaled from theſe inſects is ſo corroſive and irritating, that the gathering them is attended with danger. In that occupation, the labourers, who imprudently collect them in the heat of the day, and with their hands uncovered, are frequently ſeized with a violent heat of urine, and voiding of blood. The ſame accidents befal thoſe who unwarily ſleep under the trees they frequent.

The

* Dale Pharm. p. 391.

The female cantharidis ſeems to feel the acceſs of amorous deſire in a more violent degree than the male: It is ſhe that courts the male; and in the great act of fecundation, it is ſhe that occupies that place, to which in moſt animals nature directs the other ſex. After impregnation, ſhe depoſits her eggs in the ground, where they remain till they have undergone the various changes that are to bring them forth winged cantharides.

When collected and dried, theſe inſects become ſo light, that fifty of them hardly weigh a dram: it is in that ſtate they are grinded down into the well known powder, which conſtitutes the baſis of the common bliſtering plaiſter. Of the other purpoſes to which they have been applied, ignorance is perhaps better than information; and we freely reſign to the annaliſts of diſſipation, the taſk of recording thoſe vain attempts in which they have been employed by the enervated debaucher to reſtore his virility. The enterpriſes of love, like the fatigues of war, require certain intervals of reſt and tranquillity, without which neither the lover nor the ſoldier can take the field without hazarding his reputation *.

* Militat omnis amans, et habet ſua caſtra cupido, OVID.

## Genus XXVIII.—*Mordella. The Nibbler.*

This genus has the antennæ filiform, and ſerrated; the head bent under the neck; the palpi clubbed, and obliquely truncated. The elytra are curvated, or ſloping down towards the tail; and a broad lamina is ſeated at the baſe of the abdomen before the thighs *. There are only ſix ſpecies of the mordella known to naturaliſts; of theſe the mordella aculeata is quite black and ſmooth. The abdomen terminates in a ſharp point, and extends a conſiderable length beyond the tips of the elytra.

The yellow mordella is of a ſmall ſize, and of a dark ſhade of that colour. The elytra bend downwards at the extremity, where they aſſume a ferruginous colour: The point of the abdomen, which extends beyond them, is of an obſcure black.



* Syſtema Natura, p. 682.

## Genus XXIX.—*Staphylinus.*

The antennæ of this ſingular tribe are moniliform: The elytra, by which they are readily diſtinguiſhed, ſeem as if cut through by the middle, and do not extend half the length of the abdomen. Under theſe caſes the wings are folded up, and concealed. The extremity of the abdomen is unarmed, but provided with two oblong veſicles which the inſect can ſhoot out or retract, at pleaſure.

The ſtaphylini are ſometimes ſeen upon flowers; but their principal reſort is to the dung of cows. All of them when touched turn up the tail, as if with an intention to ſting. They are, however, unprovided with that inſtrument, but bite ſeverely with their jaws when laid hold of. In their larva ſtate, theſe inſects ſo much reſemble the perfect animal, that they cannot eaſily be diſtinguiſhed *.

Staphylinus maxillofus, is the largeſt *Britiſh* inſect of this genus. The jaws, from which it obtains its *Linnæan* name, are ſharp, hard, and rather longer than the head. The whole inſect, both above and below, is of a deep black: The elytra do not cover more than one third of the abdomen, which appears beyond them, rough and hairy. The legs are long; each of the tarſi is provided with a tuft of hair reſembling a bruſh. This and the other ſpecies can fly by means of large wings, which unfold from under the elytra †.

* Barbut, p. 95. † Rai Inſ. p. 109. n. 1.

## GENUS XXX.—*Forficula. The Earwig.*

THIS genus contains ſome ſpecies of inſects that are univerſally known. Their common characters are ſetaceous antennæ; elytra ſhorter than the abdomen; wings folded up and covered by the elytra; and a forceps, by which the extremity is armed *.

Forficula auricularia. This inſect is ſeen every where; it even enters our inmoſt apartments. The body is of a yellow colour, inclining to brown; dark above, and lighter underneath. The forceps with which the earwig is provided, procured the generic name forficula to this tribe. The formidable name of earwig has ariſen from a notion, that theſe inſects entered into the ears of people while aſleep, and from thence penetrated into the brain, where they occaſioned much pain; often madneſs and death: The *French* appellation, which ſignifies the Ear-piercer, urges this accuſation in ſtill plainer terms.

The ſmalleſt acquaintance with the ſtructure of the human ear, will eaſily prove the fallacy of theſe ſuſpicions, which have in all probability often coſt this animal its life. It, however, deſtroys flowers; and wherever fruit has been wounded by ſtronger inſects, the earwig generally attends for a ſecond feaſt.

All theſe animals after fecundation lay eggs, from which caterpillars are produced, that differ but little



* Syſtema Nat. p. 686.

from the perfect infect. It is amazing in how little room the long wings of thefe animals are packed before they burft from their chryfalid ftate; and even after they are protruded, the animal, by means of the joints and mufcles with which they are furnifhed, folds them up under the elytra, that you would imagine it altogether deprived of thefe inftruments *.

The life of the earwig, after it enters upon its winged ftate, lafts but a few days; each fex is then conftantly in purfuit of the other, and that fhort exiftence feems chiefly employed in the bufinefs of procreation: After having provided for pofterity, the parent animal dries up, and dies to all appearance confumptive †.

* Swammerdam, p. 114. † Goldfmith, p. 358.

# CHAPTER III.

## Section I.

### Order II.—*Hemiptera.*

We are now come to the order of hemipterous infects, which comprehends the different kinds of locuſts and graſhoppers, and, in general, all thoſe animals whoſe antennæ are ſetaceous, and heads inflected. Their elytra and wings are extended, ſmooth, and ſemicoriaceous; being of a ſubſtance ſomewhat like vellum. The thorax is horizontally flattened, of an orbicular form, and marginated round the extremities: The feet are formed, in moſt ſpecies*, for running; and the abdomen is terminated by two ſmall appendices reſembling horns. They are termed *hemiptera*, becauſe only half of their wings appear when in a ſtate of reſt: They do not then meet together in a longitudinal ſuture like thoſe of the laſt order, but have ſome part of their interior margins croſſed, or laid one over the other, above the abdomen.

* Pedes curſorii, Lin. Syſt.

## Genus I.—*Blatta.*

This order of infects has been fubdivided into eleven different genera; the firſt of theſe is the blatta, or cockroach, which comprehends that well known ſpecies of animals which frequent kitchens and bakehouſes. Their appearance is ugly and deformed; they ſeldom, however, preſent themſelves by day; and though in our immediate vicinity, and of conſiderable ſize, they are but rarely ſeen. If ſurpriſed in their haunts while it is light, they ſpeedily eſcape by running; their wings being unfit for flight, except in the males of ſome ſpecies who make awkward attempts at flying. The night is their ſeaſon of activity, when they iſſue from the crevices near the chimney in queſt of crumbs of bread or dough.

In this iſland the cockroach is probably always a domeſtic animal: In warmer countries, however, there are different kinds which haunt the fields in great numbers. The hakkerlac of the American iſles, that voracious animal, which ſo greedily devours the proviſions of the inhabitants, is of this genus. That inſect, like our cockroach, ſhuns the light of day; during which it lies concealed in ſome hole, till darkneſs approach, to favour thoſe depredations for which it has long been ſo infamous in the New World.

The larvæ of all the different ſpecies of blattæ differs but little from the perfect inſect, excepting in the total want of the wings and elytra. In that ſtate, meal is its common

common food; and of that neceſſary of life it is then extremely voracious. When meal is wanting, as muſt happen in the fields, it corrodes the roots of plants. After having attained its full complement of limbs, and acquired its moſt perfect form, the cockroach diſplays a mouth armed with jaws, and furniſhed with palpi. Its antennæ are generally as long as the body, and the abdomen as broad as the thorax. The tarſi of the fore feet have five joints; thoſe of the hinder only four; while the horns which terminate the abdomen are furrowed, or wrinkled tranſverſely *. There are ten ſpecies of this genus, named, for the moſt part, after the different countries which they inhabit.

* Barbut, Order II. Gen. 1.

## Genus II.—*Mantis, or Soothsayer.*

The insects of this genus possess a form the most romantic and extraordinary that is perhaps presented by any animated being; and so powerfully have their singular attitudes operated on the minds of the credulous and ignorant, that superstition has invested them with certain powers that are altogether unexemplified by any part of the history of animated nature. By the singular manner in which the soothsayer stretches out its fore legs, it has acquired the reputation of a diviner, who could unfold all the secrets in the bosom of futurity; and because the insect often sits upon its four hind legs, having the two fore ones raised up and folded together, the believing multitude have supposed it to be then holding intercourse with the Supreme Power, in the exercise of devotion *; a circumstance from which it has obtained from the peasants of *Languedoc* the name of *Pregadiou*, or the God-prayer. It is in that province, where these animals abound, that the country people have also ascribed to the soothsayer another very commendable quality; that of obligingly shewing the way to strangers: This it is supposed to do, by that peculiar habit which it has of stretching its fore legs sometimes to the right, and sometimes to its left side. These superstitions of the vulgar have been as favourable to the security of these animals, as they are disgraceful to human reason; for they have procured them a character almost

* Vide Goedart.

almoſt ſacred; and the injuring them is reckoned a crime of no ſmall enormity †.

The inſects of this genus are diſtinguiſhed by an unſteady nodding motion of the head, which gives it the appearance of being ſlightly attached to the thorax. The mouth is furniſhed with jaws and palpi; and the antennæ are ſetaceous. The four wings are membranous, and wrapped cloſe round the body. The anterior pair of feet are compreſſed laterally, and ſerrated on one ſide, their extremities terminating in a ſingle nail. The four back feet are ſmooth and greſſory, being formed rather for advancing ſlowly than for performing quick movements. The thorax is throughout of an equal ſize, narrow, and in ſome ſpecies extending to a diſproportionate length ‡.

The moſt remarkable of theſe animals is the mantis gongylodes of *China*. The thorax is uncommonly long and narrow; the head ſmall and flat, with two ſhort filiform antennæ; behind theſe, two large poliſhed eyes are placed; the roſtrum has the ſhape of an awl, but often ſplit towards the extremity into two points. The elytra, which cover two thirds of the body of the inſect, are reticulated, and croſſed the one over the other; the wings which they cover are veined and diaphanous. The four hind legs have the appearance of being winged, on account of thoſe large membranous lobes which emerge from their joints. The anterior pair are armed with ſpines at their firſt articulation, and towards their extremities they are ſerrated on one ſide ¶.



† Reaumur, Tom. IV. ‡ Syſtema Nat. Ord. II.

¶ Vide Barbut's Gen. Inſect. Ord. II. Gen. 2.

## Genus IV.—*Gryllus.*

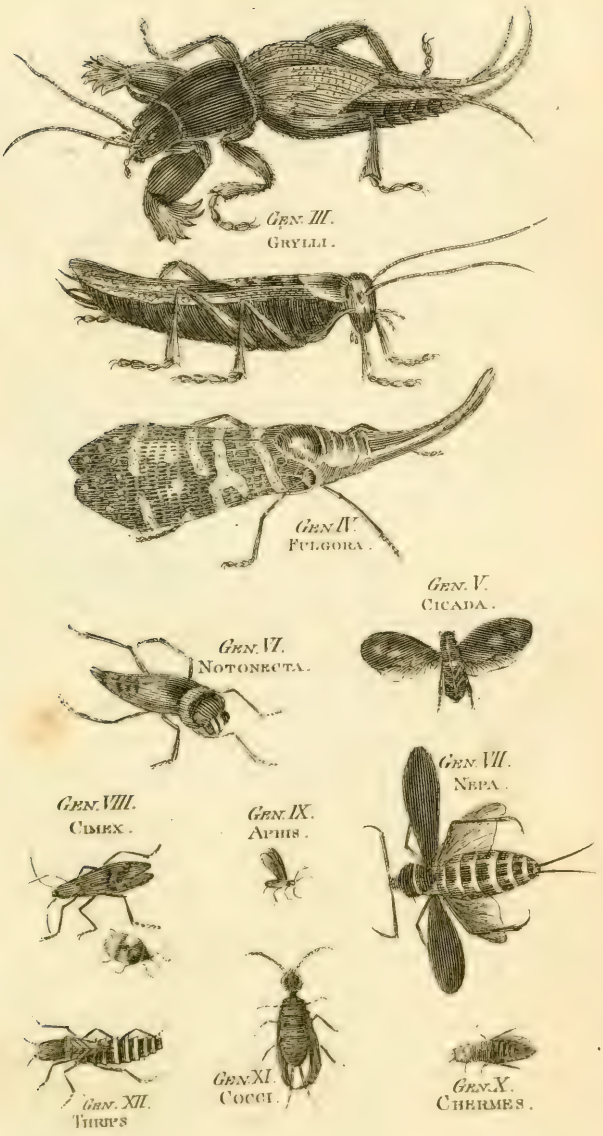
This deſtructive genus comprehends all the different kinds of locuſts, and is divided by *Linnæus* into five tribes, containing ſixty-one different kinds of animals. Their general characters are, a head inflected, armed with jaws, and furniſhed with palpi; the antennæ in ſome ſpecies are ſetaceous; in others filiform: the wings are wrapped round the ſides of the body; the under one folded, and concealed under the elytra. All the feet are armed with two nails; the hind pair formed for leaping.

The tribe of achetæ, which comprehends in it all the different ſpecies of crickets, is diſtinguiſhed by the briſtles which ſpring from the extremity of the abdomen, and by the three articulations of which their tarſi are compoſed. This family have obtained their *Engliſh* name from the continual tireſome noiſe which they produce. The domeſtic achetæ uſually take up their abode in ovens, and in the holes of walls around kitchen chimneys, where they are attracted by the heat, and are very noiſy companions to the country people, who, from ſome prejudice in their favour, ſeldom wiſh to deſtroy them.

The field cricket remains, during the day, pent up in ſome ſubterraneous habitation, from whence it iſſues forth about ſunſet; when, in countries where theſe animals abound, the whole fields ring with their noiſe.

The mole cricket is by far the moſt hideous and extraordinary inſect belonging to this tribe. It has obtained its

Plate V.


Gen. III.
Grylli.
Gen. IV.
Fulgora.
Gen. V.
Cicada.
Gen. VI.
Notonecta.
Gen. VII.
Nepa.
Gen. VIII.
Cimex.
Gen. IX.
Aphis.
Gen. XI.
Cocci.
Gen. X.
Chermes.
Gen. XII.
Thrips

its name * from the ſingular ſtructure of its fore legs, which are extremely broad and flat, and terminate in ſix large ſerrated claws, ſomewhat reſembling the fore feet of a mole. The whole animal is of a brown, duſky colour, very large, and active. It frequently takes up its reſidence in hot-beds, to the great diſturbance of the gardener; for it digs under ground, like the animal after which it is called, committing dreadful havoc among the tender roots of the plants that are artificially raiſed there. It is frequent in *France*, where the gardeners know it by the name of *courtilliere*.

The tettigonia, or tribe of graſhoppers, is the next ſection into which the grylli are divided; and of it, the gryllus viridiſſimus is the moſt remarkable. Its colour is a pale green, the antennæ ſetaceous, and longer than the body. The elytra are clouded, and the wings reticulated; both extend beyond the body about one third of its length. The female carries, at the extremity of her abdomen, a kind of ſerrated ſpine, compoſed of two laminæ, and in ſhape broad, and turned up like the blade of a cutlaſs. Theſe implements are employed by the female in digging in the ground, or in wood, holes for the reception of her ova; and this being a function in which the male has no ſhare, he is unprovided with the inſtruments by which it is performed †.

The female graſhopper poſſeſſes an amazing fecundity; ſhe regularly depoſits from four to ſeven hundred eggs at a time ‡. The wonderful precautions which ſhe takes for providing them ſecurity, and food for the young as



* Gryllo-talpa, Linnæus.

† Barbut's Gen. Inſect. page 115.

‡ Memoir. pour ſervir a L'Hiſt. des Inſect. Tome IV.

ſoon as they are diſcloſed, merit our particular notice. With that lancet, which we have already deſcribed, ſhe excavates a number of holes in the dried branch of a tree; into each of theſe holes eight or ten of her eggs are dropped; there they are ſurrounded with that kind of food which is moſt ſuitable for them in their larvæ ſtate. The diſpoſition of the eggs is in rows, and placed in the middle of the trees; the ſoft ſubſtance of which is the firſt food of the inſect after it leaves the ovum. The inſect that proceeds from each of theſe eggs, after it has grown for ſome time, and before reaching a ſize incompatible with eſcaping by the narrow mouth of the hole, takes a final departure from the place of its birth.

The larvæ having thus left their egg ſtate, and acquired the uſe of their limbs, the two anterior of which are formed for digging the ground, ſoon apply them to that purpoſe, and excavate for themſelves a ſubterraneous retreat among the roots of plants, which they gnaw, and ſupport themſelves upon the juices that exſude from them *. In this ſtate they remain till they are ready to undergo another transformation, which introduces them into the open air in the form of winged inſects.

A ſhort time after, the graſhopper appears in its laſt ſtage of perfection; it ſpreads over the meadows, which it fills with its chirruping ſtrains, which are the calls of the male inviting the female to love. Some naturaliſts are of opinion that the notes of the graſhopper are produced by rubbing the two hind legs of the animal againſt each other. *M. de Reaumur* and *Linnæus*, who have minutely examined theſe inſects, derive their vocal powers from a very different ſource. On examining the male,



* Vide Mémoires ubi ſupra.

his body has been found provided with a ſmall hole below the inſertion of each wing, delicately conſtructed with organs of ſound within, and covered over externally with a fine tranſparent membrane. It is by means of theſe organs, which, in the completeneſs and delicacy of their ſtructure, may vie with thoſe of the human voice, that ſome ſpecies of the graſhoppers produce their melody. The cicada of the ancients, ſo famous for beguiling the labours of the huſbandman by his melodious notes, is an animal very different from our graſhopper: The former either walked or flew; and it was from the ſummit of a tree that it poured forth thoſe delicate notes, ſo much celebrated by the *Grecian* poet *.

The note of the graſhopper is ſeldom heard, without being returned by another male of the ſame ſpecies; and the two little animals, after many mutual inſults of this kind, are ſeen to meet and fight deſperately. The female is generally the reward of victory; for, after the combat, the male ſeizes her with his teeth behind the neck, and thus keeps her for ſeveral hours, till the buſineſs of fecundation is performed: They are at that time ſo ſtrongly united, that they can ſcarcely be ſeparated without tearing them aſunder †.

After fecundation by the male, and towards the cloſe of ſummer, the female is ſeen diſtended with the ſeeds of a future family; and ſhe prepares for depoſiting her numerous ova in the manner we have already mentioned. The eggs are white, of an oval ſhape, and horny conſiſtency. In ſize, they are nearly equal to a grain of aniſe; and while in the body of the female, they are inveloped within

* Vide the Odes of Anacreon.

† Goldſmith's Nat. Hiſt. Vol. VII. p. 334.

within a covering, branched all over with veins and arteries. In this form they remain depoſited under the ſurface of the earth, or incloſed in wood, apparently unaffected by the rigour of winter, till the genial heat of ſpring begin to hatch and vivify them. Then, the ſun beginning with its warmth to animate all nature, the inſect eggs feel its benign influence; and generally about the beginning of May, each egg produces a larva about the ſize of a flea, at firſt of a white colour, but afterwards gradually turning brown.

After having taken theſe meaſures for perpetuating her kind, the parent animal does not long ſurvive; as the winter approaches, ſhe dries up, ſeems to feel the effects of age, and dies from a total decay. Some aſſert that ſhe is killed by the cold; others, that ſhe is eaten by worms; but certain it is, that neither male nor female are ſeen to ſurvive the winter.

When examined internally, the graſhopper diſcovers a very ſingular and complicated ſtructure of viſcera; beſides the gullet, there is obſerved a ſmall ſtomach; and behind that a very large one; ſtill lower down, there is yet a third: So that it is not without ſome foundation, that all the animals of this tribe have been ſuppoſed to chew the cud, as they ſo much reſemble ruminating animals in their internal conformation. *Ariſtotle* informs us, that they were greedily ſought after as a delicate morſel by the *Greeks*; and that the ſeaſon when they were deemed moſt delicious was a ſhort time before they left their chryſalis ſtate *. The metamorphoſes from that ſtate is performed with great difficulty and agitation; many periſh in this ſevere effort of nature, and thoſe who ſurvive are for ſome time in a languid and debilitated ſtate †.

* Hiſtoria Animalium. † Reamur, Tom. IV. p. 188.

## Section II.

The locuſts occupy the next ſection of this genus; a race of animals, unhappily for mankind, by far too well known by their deſtructive effects on the productions of the earth in many of the warmer regions of *Aſia* and *Africa*. They are diſtinguiſhed by a ſimple tail, and filiform antennæ *. The former of theſe members is deſtitute of thoſe ſetaceous briſtles which characteriſe the achetæ, and of the tube which is peculiar to the tettigoniæ already deſcribed. The locuſts conſtitute a multifarious group of the moſt voracious and prolific inſects which are viſible to the naked eye. Some of them are of a large ſize, others ſmall; ſome are green, others red or yellow. Among us they receive various denominations, according to their ſize and colour: When of one form, they are called locuſts; thoſe of another, graſhoppers; and a third ſort are termed crickets †.

Many of the locuſts far exceed the graſhopper tribe in bulk, in rapidity of flight, and the powers of injuring mankind, by ſwarming upon the productions of the earth. The latter animals are unable to fly any conſiderable length; and the quantity of vegetable food which a few of them ſporting among the grais can deſtroy, is ſcarcely perceptible; but when a ſwarm of locuſts, ſeveral miles in length, and two or three yards deep, ſettle upon a field, the conſequences are truly alarming. The annals of

* Syſtema Naturæ. † Barbut's Genera Inſect. p. 117.

of many countries in the Eaſt have recorded their devaſtations, which at different periods have threatened the extinction of the human race. Happily for the inhabitants of *Europe*, the coldneſs of their climate, and the humidity of their ſoil, are unfavourable to their production. In ſome of the ſouthern kingdoms, their viſitations, though far leſs frequent than formerly, are ſtill an object of terror: In general, however, their incurſions are fatal to theſe animals; they viſit us and periſh.

The ſacred ſcriptures, which were written in a country where the ſwarms of locuſts made a diſtinguiſhed feature in the picture of nature, have given us many ſtriking repreſentations of the numbers and rapacity of theſe inſects: They compare, according to the manner of the oriental languages, an army of which the numbers are beyond computation, to a ſwarm of locuſts: They deſcribe them as riſing out of the earth, where they were produced; as purſuing a ſettled march, for the purpoſe of deſtroying its fruits; and as co-operating with the divine indignation in puniſhing the ſins of men.

When the locuſts take the field, they have, as it is ſaid, a leader at their head, whoſe flight they obſerve, and pay a ſtrict attention to all his motions. They appear at a diſtance as a black cloud, which, as it approaches, gathers upon the horizon, and almoſt hides the light of day. It often happens that the huſbandman ſees this imminent calamity paſs away without doing him any miſchief, and the whole ſwarm to proceed onward, to ſettle upon the labours of ſome leſs fortunate people: But wretched is the diſtrict upon which they alight. They ravage the meadow and the paſture ground, ſtrip the trees of their leaves, and the gardens of every vegetable.

The

The viſitation of a few minutes deſtroys the hopes of a year; and a famine but too frequently enſues.

In their native tropical climates, the locuſts are ſaid not to be ſo dreadful as in the more ſouthern parts of *Europe*, and the oppoſite coaſts of the *Mediterranean*: There, though the plain and the foreſt be ſtripped of their verdure, the power of vegetation is ſo great, that an interval of three or four days repairs the calamity. But our verdure is the livery of a ſeaſon, and we muſt wait till the enſuing ſpring repair the damage; beſides, in their long flight to this part of the world, they are famiſhed by the tedioufneſs of their journey, and are therefore more voracious wherever they happen to ſettle *.

But it is not by what they devour, that the locuſts do ſo much damage, as by what they deſtroy; their very bite is thought to contaminate the plant, and prevents its vegetation: to uſe the expreſſion of the huſbandmen, they burn whatever they touch, and leave the marks of their devaſtations for two or three years. The bite of many animals operates like a poiſon to vegetables; and if this be the caſe, it does not appear that the depredations of theſe inſects can, in any country, be ſoon repaired.

Such are the fatal effects of the voracity of the locuſts while alive; and when dead they ſometimes prove ſtill more noxious, by infecting the air with a ſtench that is inſupportable. *Oroſius* tells us, that in the year of the world 3800, there was an incredible number of theſe inſects which infeſted *Africa*; and after having eaten up every thing that was green, they flew off, and were



* Goldſmith's Nat. Hiſt. Vol. 7th p. 345.

drowned in the *African* ſea, where they cauſed ſuch a ſtench that the putrifying bodies of many thouſand men could not have produced effluvia ſo peſtilential.

The eaſtern borders of the *Ruſſian* empire, are ſubjected ſometimes to the awful viſitations of this inſect: That which happened in 1690, which extended from *Ruſſia* over a great part of *Poland* and *Lithuania*, was ſingularly deſtructive. In ſome places the locuſts were ſeen lying dead, heaped upon each other four feet deep; in others they covered the ſurface like a black cloth; the trees were ſeen bending beneath their weight, and the damage which the inhabitants ſuſtained was beyond computation.

In *Barbary* their numbers are alſo formidable, and their viſits more frequent: During the year 1724, a traveller from *Britain*, remarkable for the accuracy of his obſervations, witneſſed the havoc they committed in that ill fated country *. Towards the end of *March* they began to appear with a ſoutherly wind: During the ſucceeding months, their numbers continued to increaſe ſo prodigiouſly, that during the heat of the day they roſe in ſwarms ſo large as to darken the ſun. In the middle of *May* they began to retire, for the purpoſe of depoſiting their eggs in the drier plains of the interior country.

About the middle of ſummer the young, already ripe for devaſtation, made another incurſion, in ſeveral bodies of a vaſt extent; although then in the form of worms they crawled forward, climbed the trees, walls and houſes, devouring every plant in their way: It was in vain that the inhabitants dug trenches through their fields and

* Dr. Shaw in his travels through Africa.

and filled them with water; in vain they collected large rows of heath, ſtubble, and other combuſtible matter to ſet them on fire on the approach of the locuſts. The trenches were ſoon filled, and the fires extinguiſhed by the immenſe ſwarms that ſucceeded each other.

The locuſts which are thus active in their larva ſtate, remain only about a month in that form; after having completed their growth, they caſt that ſkin which gave them their vermicular ſhape; and, in order to prepare themſelves for this transformation, they attach their hind legs to ſome twig, where, after ſome laborious efforts, and ſeveral undulating motions, they at laſt burſt the ſkin: at firſt, the head only appears, but ſoon after the reſt of the body is diſengaged, the whole operation continuing only for ſeven or eight minutes. After caſting their covering they remain for a little in a languiſhing ſtate, till the air hardens their wings, and the heat of the ſun again invigorates them, when they reſume their former voracious habits, with an increaſe both of ſtrength and agility *.

In ſome parts of the world the inhabitants convert what ſo generally is conſidered as a plague, to an advantage, by making the locuſts an article of food. It is for this purpoſe, that in many parts of the eaſt they are caught in ſmall nets, which are conſtructed for entangling them. When a ſufficient quantity is thus procured, they are roaſted over the fire in an earthen pan till the wings and legs drop off: when thus prepared they are reckoned tolerable food, and are ſaid to taſte like crayfiſh †.

In *Tonquin* nets are uſed in dragging a ſpecies of them out of the rivers, into which they frequently fall from their



* Dr. Shaw's travels. † Dampier's voyages.

unwieldineſs in the months of *January* and *February*.—This locuſt, which is reckoned a great delicacy both by the rich and poor, is eaten freſh after being broiled on the coals: It is of the ſize of the top of the finger, and as long as the firſt joint; inhabits the low grounds, where it breeds, till the winter ſeaſon, when it ſpreads over the country in vaſt ſwarms. In all countries where the locuſt is an article of food, it is regularly brought to market, like ſhell-fiſh or ſmall birds in *Europe*. They muſt have conſtituted a common food among the *Jews*, ſince *Moſes*, their lawgiver, has condeſcended to ſpecify the different kinds which they were permitted to eat *.

From participating of this luxury of the *Jews*, however, the inhabitants of *Britain* may deem themſelves happy in being excluded. Since the year 1748, none of the deſtructive ſpecies have viſited this iſland: At that period, the great brown locuſt was ſeen in ſeveral parts of *England*, and many dreadful conſequences were apprehended from its appearance. The body of this inſect is about three inches long; the antennæ are extended about one third of this length from the head, which is brown. The ſhield which covers the back is greeniſh; the upper ſide of the body is brown, ſpotted with black, and the under ſide is purple.

The great *Weſt Indian* locuſt, of all the animals of this genus, is the moſt formidable, when individually conſidered. The body is about the thickneſs of a gooſe quill, divided into ten annuli, and is ſix inches in length: It has two ſmall eyes ſtanding out of the head, like thoſe of crabs

* Vide Levit. chap. xi. v. 22. Even theſe thou mayeſt eat; the locuſt after his kind; the bald locuſt after his kind; the beetle after his kind; and the graſhopper after his kind.

crabs ; and two filiform antennæ. The whole body is ſtudded with ſmall excreſcences, which are not much larger than the points of pins : Its ſhape is roundiſh, diminiſhing in circumference towards the tail, which is bifurcated ; between theſe forks, the animal is armed with a dangerous ſting, which invariably wounds any perſon who touches it. The poiſonous matter with which this inſtrument is loaded, occaſions a ſhivering and palpitation all over the body, which the inhabitants cure by rubbing the wound with palm oil †.

† Goldſmith's Nat. Hiſt. Vol. VII. p. 348.

## Section III.

### Genus IV.—*The Fulgora, or Lanthorn-fly.*

The infects of this genus are rare in *Britain*, only two fpecies being caught in the iſland. It is the foreign animals of this tribe which have the ſingular quality of emitting flaſhes of light when they fly. This phenomenon is thought to be occaſioned by the waving of the elytra, whoſe thinneſs renders the ſpots upon them tranſparent: The effect is probably heightened by ſome reſplendent quality peculiar to the tribe, and by the golden yellow of the under wings bordered with black. However this may be, it is certain that in *China* there is a certain ſpecies of the fulgora, which blazes with an amazing luſtre, that marks the path of the animal wherever it directs its courſe, and which in the minds of the timid and ſuperſtitious, creates images of danger of the moſt tremendous kind.

*Linnæus* enumerates nine different ſpecies, one only of which he has termed *European* from its reſidence in that quarter of the globe. They are all characteriſed by a long projection from the forepart of the head, of a light and empty ſubſtance. The antennæ are ſeated below the eyes, having two articulations, the exterior of which is largeſt, and of a globular form; the roſtrum is bended inward

inward under the body; the feet are greſſory, or formed for walking *. In theſe animals the elytra commonly decline along the ſides, and when at reſt cover the whole of the abdomen; for they gradually increaſe in breadth from the baſe to the extremities.

The fulgora candelaria of *Linnæus*, is of a freſh green colour; on the ground of the elytra figured and ſtriated with lines of a pale yellow; the wings are of a deep and beautiful yellow, with a band of gloſſy black, bordering their extremities; the head and thorax are generally of a ruddy brown, and the animal emits flaſhes of lightning as it flies in the dark.

* Syſtema Natura, Ord. ii. Gen. 4.

## Genus V.—*The Cicada, or Flea locuſt.*

The inſects of this tribe, obtain ſometimes the name of graſhoppers, or froghoppers, as well as the tettigoniæ already mentioned. They are far inferior in ſize as well as in their deſtructive powers, being produced from ſmall larvæ that are found on plants reſembling the ſix-legged worm. Some of theſe larvæ have the ſingular property of voiding from the anus and the cuticular pores, ſmall bubbles which unite together, and form a ſpecies of foam in which the young animal remains enveloped.

This foam, which is not unlike a ſpittle, is in ſome parts called the cuckoo-ſpittle, and is probably intended by nature as a ſhelter to the larvæ, againſt the ſearch of other animals to which it would fall a prey: Perhaps, too, this moiſture may be deſigned for ſereening the inſect, in its tender age, from the beams of the ſun, and the rough elements by which its body might then be injured *.

Whatever purpoſes this froth may be intended to ſerve, it is undoubtedly neceſſary to the ſubſiſtence of the animal †, for it is no ſooner wiped away, than a freſh quantity is ſeen exſuding from all parts. During its reſidence in this ſpume, the animal acquires four tubercles on its back, in which the wings are incloſed; as ſoon as theſe

* Barbut's Genera Inſect. p. 122.

† De Geer artes de Stockholm, 1741. p. 221.

theſe burſt, from a reptile it becomes a winged inſect; thus rendered complete in all its parts, it flies to meet its mate, and propagate its kind *.

Other larvæ are unprovided by nature with a frothy covering; their bodies are not ſo eaſily injured; and they are enabled to eſcape from their purſuers by the nimbleneſs of their running and leaping. The chryſalids and larvæ that produce them differ but little from each other, either in their form or habits: Both run, leap, and climb upon plants; the former diſtinguiſhed by ſmall knobs upon the back, the rudiments of future wings.

When arrived at their moſt perfect form, the males of many kinds poſſeſs the faculty of ſinging, by means of an organ ſituated under the abdomen, furniſhed with valves and muſcles. It is by the help of this ſonorous inſtrument that the male amorouſly ſolicits his mate; and from this lively and animated ſong, the country people preſage a fine ſummer and plentiful harveſt †.

The cicadæ have for their generic marks, the roſtrum inflected; the antennæ ſetaceous; the four wings membranous, and the feet formed, for the moſt part, for leaping ‡. Their heads are generally of a triangular ſhape; their bodies are oblong; and the wings faſtigiated, like a roof. The females poſſeſs, at the extremity of the abdomen, two large laminæ, between which is incloſed a kind of blade, ſerrated on the edges. This apparatus appears plainly intended for digging holes for the reception of the young, and for ſinking them in theſe plants upon which the larvæ are to feed, after their excluſion from the eggs.



* Goldſmith's Nat. Hiſt. Vol. VII. p. 258.

† Barbut ubi ſupra. ‡ Syſt. Nat. Ord. II. Gen. 5.

The genus of cicadæ is divided by *Linnæus* into five tribes or families, viz. into those whose thorax is compreſſed, membranous, and larger than the body; thoſe which have their thorax armed on each ſide with a ſpine or horn; the third, the manniferæ, whoſe feet are not formed for leaping; the fourth conſiſts of thoſe whoſe hind feet are made for that purpoſe; the laſt family comprehends thoſe whoſe wings are wrapped round the body *.

The cicada ſanguinolenta of *Linnæus* is the moſt beautiful of all our froghoppers: It is of a ſhining black, both above and below; the elytra have each three large ſpots of a fine crimſon.

* Syſtema Nat. ubi ſupra.

## Genus VI.—*The Notonecta, or Boat-fly.*

The flies of this genus have the roſtrum bent in towards the thorax, the antennæ very ſhort, and the four wings croſſed over each other *. The ſix feet are all formed for ſwimming; and the abdomen is terminated by four horny appendices. This tribe comprehends in it only three ſpecies; the grey, the ſtriated, and the ſmall notonectæ.

The firſt is of a pale colour, mixed with black, and is very common upon ſtagnated water †; the head is round, and for the greateſt part occupied by two large brown eyes; the antennæ are very ſmall, of a yellow colour, and inſerted in the under part of the head; the elytra are of a ruſty cloudy colour, large, and croſſed one over the other.

The ſecond ſpecies alſo frequents the water, is much ſmaller than the former, and emits a diſagreeable odour. The elytra are pale, ſtriated with a number of undulating tranſverſe lines ‡. Its ſhape is oblong; the forehead and feet of a golden yellow; the thorax brown.

The ſmall notonecta is of a ſize ſcarcely perceptible; and, according to the *Swediſh* naturaliſt, has neither wings nor elytra. The whole inſect does not appear larger than a ſmall grain of ſand, and is of a brown colour, tranſverſely ſtriated §.



* Regne Animale, p. 100.
† Vide Petivert, Gaz. t. 72.
‡ Fauna Swecica, Ord. II. Gen. 3.
§ Regne Animale, p. 102.

The notonectæ have obtained their name from the ſingular manner in which they ſwim on the back, preſenting the belly uppermoſt. This ſituation ſeems admirably fitted for the creature's manner of feeding, which is ſaid to be on the under ſide of plants that grow on the ſurface of the water; the animal, by having its mouth turned upwards, is capable of taking its food with greater convenience: Nor are its motions in the leaſt impeded by this aukward poſture; on the contrary, it is very nimble, diving down inſtantaneouſly, when it perceives danger, and riſing again to the ſurface, the two hind legs all the while ſerving for paddles *.

* Barbut, page 129.

## Genus VII.—*The Nepa, or Water Scorpion.*

The characteriſtics of theſe animals are drawn from their inflected roſtrum, the chiliform * antennæ, and the four wings folded croſswiſe, the anterior part being coriaceous. In the Syſtem of Nature there are ſix ſpecies enumerated, three of which are found in *Britain*. All theſe dwell in the water, both in the ſtate of larva and chryſalids. The eggs of the water ſcorpion are alſo depoſited in that element; they are of an oblong ſhape, and have at one extremity two or more vibriſcæ, the only part of them which is ſeen, the reſt being ſunk and concealed in the ſtalk of a bulruſh, or other water plant. Theſe plants may be removed, and placed in water near the naturaliſt, who may thus have an opportunity of ſeeing them hatched and coming forth animated larvæ immediately under his eye. The water ſcorpions, when thus excluded from the eggs, remain for ſome time in the ſtate of worms, in the place of their nativity. When they arrive at their full ſize, and are metamorphoſed into complete inſects, they are ſometimes an inch in length, and nearly half as broad. The antennæ appear in the uſual place of the fore legs †; they are armed with a forceps, well adapted to the rapacious purpoſes to which they are applied. The nepæ are of all animals the moſt tyrannical;

* i. e. Formed like a hook, or the claws of a crab.

† Vide Geoffroy, as quoted by Barbut, p. 131.

tyrannical; they deſtroy, like wolves among ſheep, twenty times as many as their hunger requires. If one of them is placed in a baſon of water with thirty or forty worms of the libellula, each as large as itſelf, it will deſtroy them all in a very ſhort ſpace, getting on their backs, and piercing them through the body with its roſtrum *.

Theſe animals, though they live upon the water by day, are capable of taking long flights from one pool to another in queſt of food: This they are probably often obliged to attempt, from the fierceneſs of their manners, by which the inſects in their vicinity muſt be ſoon deſtroyed. Though ſo formidable to other creatures, they are nevertheleſs haunted by a little louſe, which probably repays the injuries which the water ſcorpion ſo frequently commits upon others.

The cinereous ſcorpion is the moſt common inſect of this tribe: The head is ſmall, and as it were ſunk in a ſlope of the thorax; the elytra are broad, croſs each other, and cover almoſt the whole abdomen: In the females, the extremity is furniſhed with two appendices, equal to three fourths of its length.

* Goldſmith's Nat. Hiſt. Vol. VII. p. 360.

## GENUS VIII.—*Cimex. The Bug.*

WE are now to examine a tribe of inſects equally remarkable for their hideous appearance and their voracious habits. Of this nauſeous race *Linnæus* reckons up no leſs than an hundred and twenty-one different kinds, all diſtinguiſhed by theſe general characters: an inflected roſtrum; antennæ longer than the thorax; wings folded together croſswiſe; the forepart of the upper ones coriaceous; the back is flat, the thorax margined; and the feet are formed for running *.

For the ſake of a clearer arrangement, this numerous genus is diſtributed into eleven different ſections or families; and among theſe the *cimex lectuarius* holds the firſt ſtation. This troubleſome inmate has attracted the notice of almoſt every naturaliſt †; and it were well for the reſt of mankind, that the knowledge of it had been confined to them. By day, it lurks, like a robber, in the moſt ſecret parts of the bed and apartment; takes advantage of every chink and cranny, to make a ſecure lodgement, and contrives its habitation with ſo much art, that ſcarce any induſtry can diſcover its retreat. So cautiouſly does it avoid the light, that if candles, or a ſtrong fire, be kept burning,

* Syſtema Nat. Ord. II. Gen. 8.

† Mouffet, p. 269. Bonani. Micro. p. 65. Rai Inſ. p. 7. Aldrov. Inſ. p. 534.

burning, it will ſeldom venture from its hiding place. As ſoon, however, as darkneſs promiſes ſecurity, it iſſues from every crevice, drops from the roof, or crawls from behind the arras; and unhappy is the patient to whom theſe creatures direct their courſe. There are ſome perſons whom they do not bite; but ſuch as are ſelected for their repaſt are ſoon covered with wounds, which ſwell to a conſiderable bulk, and are often painful. In vain the ſufferer endeavours to relieve himſelf, or avenge his wrongs, by killing ſome or driving others away: famiſhed multitudes renew the attack, and occupy their place; while, in the meantime, the bed becomes inſupportable by their naufeous ſmell; nothing remains for him, but to make a timely retreat, otherwiſe he will be diſfigured and ſwolen with their wounds, and ſpend in reſtleſs agitation thoſe hours in which the weary are deſtined to reſt, and even the wretched to forget their ſorrows.

The retreats of the houſe bug, in its wild ſtate in the fields, are unknown: About a century ago, it was ſcarcely ſeen in *Britain*; and happily for the inhabitants, it multiplies leſs in this country than almoſt any part of the continent. Throughout *France*, *Italy*, and *Spain*, the beds in moſt of the inns ſwarm with bugs; and every piece of furniture ſeems to afford them a retreat. They acquire a greater ſize in proportion as the climate is warmer; they are more active, and bite with a more cruel appetite. There the weary traveller, who is ſubject to be bitten, remains the whole night like a centinel upon duty; and, inſtead of inviting the approaches of ſleep, watches the attacks of innumerable invaders, who are ready to gorge themſelves with his blood *.

3 The

* Goldſmith's Nat. Hiſt. Vol. VII. p. 282.

The houſe bug differs from all the reſt of the genus, in having neither wings nor elytra. It has two ſmall brown eyes, and two antennæ, having each three articulations: Underneath theſe lies the crooked trunk, its inſtrument of torture, which, when the animal is in motion, lies inflected upon the breaſt. The parts of generation are obvious in both ſexes: they are often ſeen coupling together in the act of procreation; two days after which, the female depoſits her eggs, to the number of an hundred and fifty.

Cleanlineſs is the beſt antidote againſt theſe animals, as their hoſtile attacks appear the proper puniſhment of its neglect. Many ſecret compoſitions are made uſe of to deſtroy them; but that object ſeems rather the effect of aſſiduity than of a cure. Mixtures have been made for this purpoſe, of ſoap, verdigriſe, and *Scotch* ſnuff, which are ſaid to be effectual. After having taken down the bed three or four different times, and waſhing it with a ſolution of corroſive ſublimate, they have been baniſhed. The ſmoke of peat, where that fuel is to be had, is the moſt efficacious of all applications, and uniformly deſtroys theſe troubleſome animals wherever it is applied.

The field bugs have all wings, and inhabit plants as various as their ſhape and colour. In their larva ſtate they are very active, and differ but little from the perfect animal, except in their wanting wings: In this ſtate, however, as well as that of a chryſalid, the animal is incapable of propagating its kind. After the laſt transformation, the wings unfold; and the impregnated female lays her eggs commonly ranged one beſide another, upon the leaf of a plant.

Theſe eggs, when viewed with a microſcope, preſent ſingular varieties of configuration: Some are crowned with a row of ſmall hairs; others wear a circular fillet; and the greater number have a cappice, which the larva puſhes off when it burſts open the egg. Releaſed by nature from their priſons, the young overſpread thoſe plants upon which they feed, extracting, by means of the roſtrum, thoſe juices which are proper for their nouriſhment. Even in this ſtate, the larvæ begin to renounce their gramenivorous and peaceable habits; ſome of them are voracious in an eminent degree, and ſpare no ſmall animal that comes in their way *.

This ſeems indeed but a prelude to that ferocity which theſe creatures diſplay in their perfect ſtate: Then they deſtroy caterpillars, flies, and many of the coleopterous inſects, which ſeem protected from their aſſaults by the hardneſs of their wings: They are then mere cannibals, who glut themſelves with the blood of every animal, not excepting even thoſe of their own genus.

The cimex hioſciami of *Linnæus*, or hen-bane bug, from its reſidence on the plant that bears that name, is deſcribed by *Ray* under the appellation of the ſmaller wood bug. Its body is of an oblong and narrow ſhape: Above, the inſect is red, variegated with black ſpots †.

Another ſpecies is alſo found on the hen-bane, with brown wings, decorated with white ſpots; it is deſcribed by *Linnæus* in the *Fauna Swecica* ‡, and is twice the ſize

* Barbut's Gen. Inſect, Ord. II. Gen. 8. † Rai Inſect. p. 55.

‡ And his Voyage to Oelande, p. 155.

ſize of the former, but reſembles it nearly in ſhape, and the diſtribution of its colours. Of the various races of bugs, ſome are found in the meadows; ſome frequent flowers; and a great many reſide among buſhes and ſhrubs, which ſeem almoſt to defy the pencil to diſcriminate them, or imitate their various hues.

## GENUS IX.—*Aphis. The Plant Louse.*

FEW insects are more common than these, while few present greater singularities to the observation of the naturalist. Plant lice are seen on the leaves of a great variety of plants, and often in society, and in considerable numbers. At certain seasons, they are viviparous, and at others they produce inanimated eggs, which remain in that state till the action of the sun call forth their vital powers. The fœtus, when the parent is viviparous, shews signs of life before it is fairly excluded from the body. Sometimes the same mother gives birth to near twenty in a day, without appearing less in bulk than before *. If one of these pregnant females are taken and pressed between the finger and the thumb, a still greater number of young will be forced from her body, one following another like a string of beads, and growing smaller and smaller, in proportion as their period of natural delivery was more remote.

*Reaumur* is of opinion that fecundation is performed among the females of this tribe, without copulating with the male †; and the experiments of succeeding naturalists have confirmed an assertion that seems to be contradicted by the analogy of all animated nature. Take a plant louse, the instant it issues from its mother; shut it up carefully from all access to congenerous animals; and if it

* Reaumur, Tom. III. p. 291.

† Memoir. pour servir a L'Hist des Insectes, Tom. III. mem. 9.

it prove a female, it will produce young: In like manner, the young produced from this virgin louſe, kept ſeparately, will produce an offspring. Some naturaliſts have repeated this experiment to the third and fourth reproduction. *Bonnet* obſerved nine ſucceſſive generations of this nature, all in the ſpace of three months. The moſt probable account of this ſingular fact ſeems to be this; that as in all animals fecundation is accompliſhed by the copulation of male and female; ſo that happens with the plant lice; but with this difference, that the fecundation produced by that act is tranſmitted for ſeveral generations, before the proliſic virtue becomes entirely exhauſted.

The young, immediately after being protruded from the mother, are always of a paler colour than the parent: They have then the entire uſe of their limbs, and go in queſt of food. All the different kinds caſt their ſkin; and it is after theſe developements that ſuch of them as have wings obtain theſe parts.

It is not the males only that are winged, as we have ſeen in ſome other genera; many of the plant lice of both ſexes are deprived of theſe inſtruments in their moſt perfect ſtate; for many of the females without them are ſeen producing young. As the larvæ of theſe inſects poſſeſs all the activity peculiar to their genus in its laſt ſtage of growth, ſo they are equally diſtinguiſhed by voracity. They are furniſhed with a ſmall trunk, which pierces the leaves, and enables the animal to extract the juices proper for its nouriſhment. Many plants grow deformed by the number of punctures thus made upon their leaves, and decay from the want of their uſual ſap. Some thrive even when covered with theſe inſects, while others riſe up into ſmall hollow tubercles, which, on being

being broken open, diſcloſe the numberleſs families that inhabit them †.

Theſe galles or excreſcences formed by the plant louſe, and which often ſo much diſfigure the ſhrubs upon which they grow, are in *China*, *Perſia*, and the *Levant*, applied ſucceſsfully in dying. Some ſpecies formed in theſe more northerly climes might probably be turned to the ſame uſeful purpoſe, were their virtues underſtood.

The plant lice are ſeen to void from the anus a clear liquid ſubſtance, of a ſaccharine nature, which is greedily ſought after by other inſects; the ſame kind of ſugary liquid oozes from the extremities of two ſmall horny appendices that terminate the abdomen. It is in purſuit of this fluid that the ants are ſeen to frequent thoſe plants upon which the plant lice ſettle in greateſt plenty. From this circumſtance, the former animals have been ſuppoſed hoſtile to the latter; while other naturaliſts have deemed it an indication of the friendſhip of the two genera for each other: but it is neither from motives of love nor of hatred that the ants repair in ſuch numbers to theſe haunts; they ſeek to gratify their avidity, by devouring their excrements.

The moſt effectual method of preventing the depredations of plant lice upon flowers and the leaves of plants, is ſuggeſted by thoſe inſects which live by preying upon them. The plant louſe-lion, or aphidivorous fly, either by inſtinct or foreſight, depoſits her eggs in the midſt of theſe animals; and as ſoon as the larvæ are produced, they devour hundreds around them, without the neceſſity of any other movement than turning to the right ſide or the left. This formidable inſect is furniſhed with two tubercular

† Reaumur ubi ſupra.

tubercular horns, with which it pierces the plant louſe, and ſucks its juice. A number of its eggs placed upon the leaves frequented by the lice, would ſoon produce a number ſufficient to ſuppreſs or deſtroy them *.

The plant louſe is a very minute inſect. Its generic characters have been thus deſcribed by naturaliſts: The roſtrum is bent inwards; the antennæ are longer than the thorax; there are four erect wings belonging to many genera, while others altogether want theſe parts; from the extremity of the abdomen there project two horny appendices; the feet have one articulation, and are formed for walking †.

*M. de Reaumur* ſuppoſes that almoſt every plant has its peculiar louſe, the colour varying according to that of the leaves upon which they reſide. Thirty-three ſpecies are reckoned up by the *Swediſh* naturaliſt.

* Reaumur, Tome III. Memoire xi. † Syſt. Nat. Ord. II. Gen. 8.

## Genus X.—*Chermes.*

Nearly allied to the laſt tribe of inſects, but of ſuperior ſize, is the chermes, a race termed *gall inſects* by *M. de Reaumur* *. Their characters are drawn from the ſituation of the roſtrum, which is placed in the breaſt; and from the ſhape of the antennæ, which are longer than the thorax. The wings are four in number, folding cloſe along the ſides of the abdomen; the feet are formed for leaping, their tarſi having two articulations.

Theſe animals are found inhabiting a great variety of different trees and plants, upon which they produce very ſingular excreſcences: The *Linnæan* names affixed to each ſpecies are for the moſt part derived from the particular tree upon which they feed; that of the fig tree is the largeſt, and therefore more eaſily examined than any of the reſt of the tribe.

The whole body of this inſect is brown above, and green beneath; the antennæ are large, hairy, and of the ſame hue with the back. The wings, which are twice the length of the abdomen, are placed ſo as to form a kind of roof, as if to protect the animal from rain †. Other ſpecies, of inferior ſize, frequent the elm, the aſh, the cherry, and the fir; that which inhabits the laſt of theſe trees is provided with a ſharp pointed inſtrument, by

* Tome III. Memoire x. † Barbut's Gen. Inſect. p. 150.

by which it makes punctures in the extremity of the branches, in order to depofit its young. By this means the fir-tree chermes produces that enormous fcaly protuberance, which is often feen at the fummit of the branches, and which is formed by the extravafation of the juices through the wounds thus made †.

The larva chermes has fix feet: In figure, it refembles the perfect infect; its fhape is oblong, and its motion flow. In the chryfalid ftate, the form is fomewhat changed, by two fmall protuberances upon the thorax, the rudiments of future wings. When the chryfalids are about to undergo their laft metamorphofes, they retreat to the under fide of a leaf, to which they remain attached without motion.

On the approach of their change, the membrane above the head and thorax is feen to fplit and open: The perfect infect then comes forth with its wings, leaving the fpoils of its chryfalis ftill adhering to the leaf, and rent on the anterior part. The empty floughs of thefe infects are often found in great plenty beneath the leaves of the fig-tree.

The tubercles raifed upon the branches of trees by the punctures of the chermes, not only become the refidence of the animal, but alfo of its eggs and larva, which are contained in thofe cells with which they abound. The box-tree chermes produces no excrefcences upon that plant: Its punctures make the leaves bend in towards each other at their extremity, where their union forms, at the fummit of the branch, a hollow knob, in which the larvæ of that infect find fhelter.



† Vide Reaumur & Frifch. Germ, xii. p. 10.

Both in their larva and chryſalid ſtate, many of the chermes eject from the anus a white ſaccharine ſubſtance reſembling manna: within the hollow balls formed by the box leaves, there are ſmall ſoft grains of this ſubſtance depoſited; and in that ſtate it is frequently ſeen iſſuing from the anus of the inſect that dwells there †.

† Barbut's Gen. Inſect. p. 152.

## GENUS II.—*Coccus*. *The Cochineal.*

THE inſects of this tribe, preſent the moſt ſingular form which we have, perhaps, yet ſurveyed in this department of animated nature. They were long imported into *Europe* as an article of commerce, before their claim to rank among animals was admitted.

The males are commonly of a ſmaller ſize than the females; the former have two erect wings, while the latter are apterous; the roſtrum is ſituated in the breaſt; the antennæ are ſetaceous, and the poiſers or halters are wanting; the poſterior part of the abdomen is briſtly, or velveted *.

Several ſpecies of theſe inſects are found upon *European* plants; that, however, upon the pimpinella roots, called the grain of ſcarlet of *Poland*, was long known in this part of the world, as a dye, before the *Mexican* cochineal was introduced. A particular hiſtory of this inſect, which is now no longer an article of commerce, ſince the diſcovery of *Mexico*, may be found in *Breynius*, as quoted by *Reaumur* †.

The drug at preſent moſt in eſtimation, for the fine colour it gives our clothes, is the cochineal of *Mexico*, an inſect domeſticated and reared with great care by the *Indians*. It grows not upon the root, but upon the



* Syſtema Naturæ, Ord. II. Gen. 2. † Tom. IV. p. 155.

leaves of a plant known by the various names of opuntia, nopal, racket, and cardaſſia. The method of cultivating them upon this tree, practiſed by the *Mexicans*, is by collecting ten or twelve together into one nidus, made of moſs or cotton; theſe inſects being put into theſe neſts, are fixed to the branches of opuntia, which is planted around their houſes.

Cochineals have not long remained in this ſtate when they produce ſwarms of young, which diſperſe and feed among the juicy leaves, and there produce a new generation. The inſects having thus multiplied, are gathered three different ſeaſons in the year: the firſt is performed by taking away the neſts that were placed originally upon the tree; the ſecond, by picking the cochineal from the leaves with pincers; and the third, at the approach of winter, by cutting off the leaves, which are yet loaded with inſects: This laſt contains animals in various ſtages of their exiſtence, and of different ſizes; it is therefore reckoned of inferior quality on that account, and alſo, becauſe, in ſcraping the leaf, ſome part of the epiderm neceſſarily comes off, and mixes with the cochineal. The *Spaniards* call it *Granilla*.

Having thus collected the inſects, the next part of the proceſs is killing them and preparing them for ſale; and according as this is performed, the cochineal is ſuppoſed to be of different quality, and obtains various names, according as its colour is ſuppoſed to be more or leſs affected. That which is prepared by the gentle heat of ovens, is of an aſh-grey, or mottled colour, and named *Jaſpeada*. If the inſects are deprived of life by plunging them with baſkets into hot water, it then goes by the name of Renegrida, and is not covered over with that white powder, common to the other kinds. Laſtly, it bears

bears the appellation of Negra, if deſtroyed upon the hot plates that have been uſed for the roaſting of maize.

But whatever be the method of preparation, that cochineal is always found ſuperior, both in quality and quantity, which has been produced upon the cultivated trees. The cultivation of the opuntia, therefore, and the raiſing cochineal, is a trade almoſt univerſal throughout *Mexico*: Eight hundred and eighty thouſand pound weight of this article, is ſaid to be annually imported into *Europe*, where it ſells at a high price *. Various are the uſes to which our luxuries, and the arts ſubſervient to them, have applied this drug. It is uſed in dyeing, and produces along with other ſubſtances, a variety of ſhades of ſcarlet: It furniſhes painters with many lively ſhades of ſcarlet, crimſon, and red: When ground into powder, it enters copiouſly into that carminative mixture which imitates the bloom of youth on the human cheek, and which is ſo frequently had recourſe to by the fair, who would repair the injuries of time †: had it really this effect, the *Mexicans*, we muſt allow, would command a treaſure of greater value than all the mines of the new world.

Some attempts have been made by the *French* to find out the cochineal in *St. Domingo*, and to rival the *Spaniards* in their lucrative commerce in that article. The ſpecimens, however, that have been produced in *Europe*, by one of the correſpondents of the academy of ſciences ‡ in that iſland, have not, hitherto, anſwered expectation, but produced a colour ſo weak as gives reaſon to doubt whether the inſect be of the ſame ſpecies. It is probable,

* Reaumur, Tom. IV. p. 106.

† Barbut, page 156. ‡ M. du Hamel, Doctor of Medicine.

ble, however, that the art of tranſporting the cochineal, like the ſilk worms, into whatever country the opuntia may grow, will ſoon be diſcovered, and the monopoly of that drug be no longer engroſſed by the *Spaniards* *.

* Reaumur Tom. IV. p. 109.

## GENUS XII.—*Thrips.*

IN this race of insects the rostrum is so obscure, from its minuteness, as to be scarce perceptible: The antennæ are filiform and as long as the thorax; the body is of equal thickness through the whole length, and slender; the four wings are extended along the back, narrow in proportion to their length, and crossed at some distance from the base; the abdomen is bent upwards, and the feet commonly have two articulations. Only five species are enumerated under this genus by *Linnæus* *.

The animals of this family are so minute, that they are not objects of discussion, unless viewed with a microscope; to the naked eye they appear rather like atoms than living animals. They reside commonly upon flowers, and under the bark of trees, and it is there also that their larvæ are found, which only differ from them by their wanting wings and elytra. The thrips juniperina, is one of the largest of this diminutive race; the thorax and abdomen are black, the elytra white. In autumn it is found in numbers among flowers, and on the juniper. *Linnæus*, for a long time, was uncertain how to arrange it, from not discovering more than one pair of wings †. *M. de Geer* first observed that it had four exceedingly narrow ones, with which it flies but little, but runs quickly ‡.

2

* Systema Naturæ, Ord. II. Gen. 12.

† Fauna Swec.

‡ Actes de Stockholm, p. 3. 1744.

# CHAPTER IV.

## SECTION I.

### ORDER III.—*Lepidopterous Insects.*

THIS order contains all the different kinds of the moth and butterfly; insects characterised by four wings, which are imbricated with scales; and by a mouth furnished with a spinal tongue, which can be extended or rolled up at pleasure. The bodies of all this class are covered with down, and their wings decorated with such a variety of brilliant colours, that they may be regarded as the most beautiful with which nature has enlivened and adorned the fields.

Plate VI

*Order III.*

*Gen. I*

Papiliones

*Gen. II.*

Sphinx.

## GENUS I.—*Papilio, the Butterfly.*

THE antennæ of this genus grow thicker, and are generally terminated with a knob or capitulum. When ſitting, the wings are not folded down, but erected ſo that their extremities nearly touch each other above the body. They are diſtinguiſhed from the moths, by flying in the day time.

Of this genus there are 273 different ſpecies, already known and deſcribed: To prevent confuſion, they have been arranged by *Linnæus* into five diſtinct claſſes, viz. the equites, the heliconii, the danai, the nymphales and the plebeii*. Each of theſe claſſes is characterized by ſome particular part; ſo that every ſpecies when examined, diſcovers immediately to what claſs it ought to be referred.

There is no claſs of inſects which hath been more accurately examined, or whoſe hiſtory hath been ſo fully detailed, as that of the butterfly and moth. Two large volumes have been dedicated ſolely to this tribe by the indefatigable *Reaumur*. The metamorphoſis of inſects is better illuſtrated by their hiſtory, becauſe in them theſe changes are more frequent, and more perceptible.

Some of theſe animals frequently caſt their ſkin, beſides undergoing thoſe more conſiderable transformations which introduce them into a new ſphere of action; be-



* Syſtema Natura, Ord. III. Gen. 4.

fore theſe develope, the outer ſkin is ſeen to wither and loſe the vivacity of its colours, owing to a new coat which already covers the animal beneath, and intercepts the juices which formerly circulated through it: After ſome efforts, this dried covering is rent towards the back part of the head, where a freſh ſkin appears; and through this aperture, the worm makes his eſcape leaving his ſpoils behind *.

After undergoing ſeveral changes of this kind, the animal prepares to undergo another ſtill more conſiderable, which is to introduce it into the ſtate of a chryſalid, deprived of almoſt all motion, and incapable of taking food. This change is effected nearly in the ſame manner as the foregoing; but in ſome it is very long in being accompliſhed. Several ſpecies of the butterfly worm, conſtruct in a very ingenious manner a coque or nut of ſilk, into which they enter before their transformation, and in which they continue for nine months, without food, before their metamorphoſes be accompliſhed †. During this long period, they are apparently inanimate, and take no food.

Various ſubſtances enter into the compoſition of the habitations conſtructed by theſe animals before their metamorphoſes; ſome are of ſilk; in others that is combined with other matter; ſeveral kinds conſtruct no habitation, but are protected by a cruſtaceous ſhell, formed by a glutinous ſubſtance, exſuding from their bodies: Some are ſuſpended vertically, while others hang horizontally by a thread which ſurrounds the middle of the body ‡.

The external form of the chryſalids varies according to the ſpecies of butterfly that inhabits them; in all, however, there are apertures oppoſite to the thorax, by which



* Reaumur, Tome I. mem. 3.
† Tome II. mem. 1.
‡ Idem Tome I. mem. 11 & 12.

reſpiration is carried on during the whole period of their inactive ſtate. After the appointed time, when the animal has acquired ſufficient vigour, the ſhell is broken, which at once conſtituted the grave of the caterpillar, and the cradle of the butterfly: the down already grown upon the inſect has completely ſeparated it on all ſides from the ſhell, which, by the action of the head, is broken oppoſite to that part, and affords free egreſs to the priſoner it ſo long confined *.

The wings of the butterfly, on its firſt appearance, are cloſely folded; but by the help of a liquor conſtantly circulating through them, they are ſoon expanded, and ſufficiently hardened, by the action of the air, to endure the efforts of flying. It is then that the inſect enters upon a more enlarged ſphere of action, with increaſed powers: He ranges from flower to flower, darting his roſtrum into their nectaria for the delicious ſtores they contain. Then too in the full poſſeſſion of every faculty granted to his race, he prepares to multiply and perpetuate it.

This laſt and moſt conſiderable metamorphoſis, is attended with a greater change in the economy of the animal, than any of the preceding; not only the ſkin, but the teeth, jaws, and *cranium*, are left behind. The large artery which paſſes along the body, may be conſidered as a ſucceſſion of different hearts employed in circulating the blood, which is at that important æra, obſerved to flow in a different direction from what it did before, like the fœtus of a quadruped after birth †. Formerly it circulated from the extremity to the head; it now purſues a courſe directly oppoſite.



* Idem, mem. 14.

† Vide Malpighi and Reaumur. Tome I. mem. 19.

The quantity of food taken by theſe animals in their laſt ſtate, is comparatively ſmall to what they formerly devoured. For a ſhort time after their appearance on the wing, their excrements are voided in a greater quantity, and red like blood; this is, perhaps, the remains of that food, which they contained before their laſt change. Its appearance on the ſurface of the earth, has at different times been regarded as portentous of ſome heavy calamity, being ſuppoſed to be blood that had dropt from the clouds *.

Some of theſe animals are gregarious, and live in ſociety during every ſtage of their exiſtence; others live in that ſtate during one period of their lives only. The duration of their life is various according to the weather; its warmth accelerates every ſtep of their progreſs, and cold retards all their developements: A worm produced in a certain period of the ſummer lives only for three months, while the ſame ſpecies, if hatched a little later in the ſeaſon, lives another year; hence, *Reaumur*, has deviſed a method of prolonging the lives of theſe animals greatly beyond their natural courſe. †.

The butterflies of every ſpecies are extremely prolific; a ſingle female at one birth produces ſeveral hundred eggs: and the moſt wonderful particular in the hiſtory of theſe inſects, is the precautions by which they provide for the ſecurity of the young; ſome tear off the down from their own bodies to ſupply them with a covering ‡.

Various

* Vie de M. Pierefe par M. Gaſſendi.

† Tom. II. mem. 1.

‡ Reaumur, Tome II. mem. 2.

Various infects prey upon the butterfly, or haften the approach of its diffolution. A certain fpecies of fly makes its way into its body, while yet a worm, and there depofits its eggs, and, although this worm continues to live, and be metamorphofed into a chryfalid, no butterfly is produced from it, thofe internal parts that were eſſential to its preſervation, being conſumed by the larvæ of the fly From the great fecundity and variety of the infects of this genus, they probably would foon cover the furface of the earth, did not nature provide a bar to their increafe, by multiplying their enemies: hence they are deſtined to become the food of a great number of animals of various kinds, fome of which fwallow them entirely, others macerate their bodies; while many accompliſh their deſtruction by gradually ſucking their juices. A ſingle pair of ſparrows, in order to ſupply themſelves and their young, may deſtroy, as is ſuppoſed, three thouſand, three hundred and ſixty butterflies in one week †.

The vaſt number of animals belonging to this genus, and the variety and richneſs of their colouring, afford ample ſcope to the painter for the exerciſe of his art. It was chiefly of theſe infects that *Madame Mariamne* exhibited thofe exquiſite drawings that conſtitute the peculiar merit of her work. It is principally in *America*, the *Eaſt Indies*, and *China*, that thofe ſpecies are found, which conſtitute the ornament of our collections. From the policy of the latter country, the ladies are circumſcribed in their amuſements; there they domeſti-



† Vide a General Treatiſe on Huſbandry, &c. by Mr Bradely, Profeſſor of Botany in Cambridge, 1724.

ate various fpecies of this tribe of infects, and make their economy and manners the principal ſtudy of their lives; large glaſs apartments, furniſhed with proper food, being fitted up for the accommodation of theſe animals.

## GENUS II.—*Sphinx*.

THIS tribe contains all thoſe inſects which hold an intermediate ſtation, between the butterflies and moths. Their antennæ are of a priſmatic form, thicker in the middle than at the extremity; their wings fold down over the back when at reſt; when on the wing their motions are ſlow and heavy. The moths, or phalænæ are nocturnal inſects. The butterfly makes its appearance in the open day; while the excurſions of the ſphinx are chiefly in the twilight of morning and evening *.

The inſects belonging to this genus, though far leſs numerous in their varieties, preſent not uniformly the ſame characters to the obſerver; ſome have angulated wings; in others, the wings are entire; ſome are known by a barb, or tuft of hair growing from the anus; while many are diſtinguiſhed by other differences in their external appearance, both in the larvæ and winged ſtate. Theſe laſt, *Linnæus* has termed *adſcitæ*, as if brought into the family by a ſort of adoption, and thus diſtinguiſhed from the legitimate ſphinxes.

The name of ſphinx has been given to the inſects of this genus from the ſingular attitude in which they are often ſeen in their caterpillar ſtate; the hinder part o the body is then ſeen attached to the branch of a tree, while

* Syſtema Naturæ, Ord. III. gen 2.

while the reſt of the body like the celebrated ſphinx ſtands in an erect poſture: The cod which they form, previous to their metamorphoſis, and into which the animal enters, is conſtructed below ground of earth and grains of corn, interwoven with threads of their own manufacture: When inveſted with the powers of a winged inſect, their voracity is diminiſhed; they fly heavily from flower to flower, introducing the tongue into the nectaria for the liquor contained there.

The ſphinx atropos is the moſt remarkable animal of this genus; the upper wings are of a blackiſh brown, waved irregularly above and below, with bands of a lighter hue; the under wings and abdomen, are of a fine yellow, variegated with tranſverſe bands of black *. The worm from which this inſect proceeds is large, ſmooth, and green, terminating in a kind of horn at the extremity †.

The moſt remarkable part of this animal is the repreſentation of a *death's head*, which is ſeen upon the upper part of the thorax: This mournful picture is formed by a large irregular gray patch, marked with two black dots near the middle ‡. In the province of *Brittany* the people were afflicted during a certain ſeaſon with an epidemic diſorder, which often proved mortal; the inhabitants were greatly alarmed by the unuſual numbers of theſe inſects, which the common people imagined came to forebode their deſtruction, by this portentous repreſentation upon their backs. The Royal Academy was conſulted, whether the ſphinx, by its uncommon numbers, might not be the cauſe of this calamity, ſo great was the alarm which their appearance created §.

* Fauna Swecica n. 809.
† Rai Inſect. p. 362. n. 62.
‡ Reaumur, Tom. I. p. 293.
§ Idem, ubi ſupra.

The ſphinx atropos, when hurt, has the power of uttering a diſmal and melancholy cry, like a mouſe; owing, as is ſuppoſed, to the violent rubbing of ſome of its ſcaly members. There are forty-ſeven different kinds of theſe animals.

## Genus III.—*Phalænæ. The Moths.*

The moths are the moſt numerous genus hitherto known, either in the animal or vegetable world: *Linnæus* has enumerated about four hundred and ſixty ſpecies, and probably is far ſhort of the real number. They are more frequent in warm and dry climates than in ours; and they are more plentiful in *South* than *North Britain*. In the former country, ſeventy different kinds have been collected; while in the latter, ſcarcely half that number have yet been noticed. The characters by which this numerous genus is diſtinguiſhed are the following: The antennæ ſetaceous, diminiſhing in thickneſs from the baſe to the extremity; their wings, when at reſt, are in general folded down; and they fly during the night. The race of moths have been further ſubdivided into eight different families. The firſt, called the attaci, have the wings hanging downwards, and ſpread open; and the antennæ are either pectinated or ſetaceous: The ſecond are named bombices, and have their wings covering the body horizontally, with pectinated and ſetaceous antennæ: The third family comprehends the noctuæ, whoſe wings are incumbent, and the antennæ ſetaceous: Thoſe of the fourth tribe are termed geometræ, and have their wings, when at reſt, extended horizontally: The tortices are diſtinguiſhed by obſcure wings, the exterior margins forming a curve: The pyralides have the inner margins of the wings laid one over the other: In the tineæ, the wings

wings are wrapped up, and folded round the body, ſo as to give the inſect a cylindrical form: And, laſtly, the family of alucitæ have their wings ſplit, or divided into different branches, almoſt to their baſe *.

The greater part of theſe phalanæ, or moths, when at liberty in the fields, only fly during the night, or towards the evening: Thoſe which are domeſticated in boxes made for that purpoſe, give indications by their fluttering within when the natural period of their activity approaches. During the day they remain quiet, and apparently reconciled to their confinement; they flutter throughout the whole extent of their priſons, and teſtify their impatience at their want of freedom.

All the diurnal butterflies are provided with a roſtrum for gathering, and for the reception of their food; a great part of the phalænæ are entirely deſtitute of that organ, while in others it is ſo ſmall as ſcarcely to be diſcernible with the naked eye. This ſingular fact hath been fully inveſtigated by the indefatigable *Reaumur*, who, after examining many moths with a ſtrong magnifier, has not been able to diſcover the ſmalleſt veſtige of a mouth †. A conſiderable number, therefore, of theſe animals, muſt paſs the whole of their winged ſtate without food: Theſe cannot be deſtructive to cloth or furs, except while they remain in the form of worms.

The caterpillars from which the various ſpecies of moths are produced, exhibit nearly the ſame variety of appearance as the winged inſects which ſpring from them. Some are large, while others are extremely minute; many are provided with ten, others twelve and fourteen feet; the largeſt and moſt common have ſixteen. Some



* Vide Syſt. Nat. Ord. III. Gen. 3. † Tom. I. Mem. vii. p. 286.

of the ſmaller caterpillars are ſmooth, and others covered with hairs, which produce an itchineſs and an inflammation, when they touch the human ſkin *.

All the caterpillars of phalænæ, after having ſeveral times caſt their ſkin, ſpin for themſelves materials of a habitation, in which they are to be transformed into chryſalids. Of all the inventions of inſects to protect themſelves during their ſtate of imbecility, that practiſed by the ſilk worm is moſt univerſally known; and if animals acquire a conſequence or reputation from their connection with man, and the conveniencies with which they accommodate him, this inſect may challenge, perhaps, a larger ſhare of it than any other animal whatever. Our luxury has brought ſilk into ſuch general requeſt, that it now may be deemed a neceſſary of life: The poor, in ſome countries at leaſt, would find it almoſt impoſſible to procure the neceſſary articles of clothing, were woollen ſtuffs worn by all thoſe who at preſent are ſupplied with ſilk.

The produce of the common ſilk worm has been found moſt proper for the purpoſe of manufacturing into cloth: That glutinous ſubſtance with which the ſilk is always covered when it firſt comes from the worm, and which gives it that adheſive quality ſo proper for conſtructing their edifices, ſooner dries than in that of any other inſect. The cods conſtructed by ſome other ſpecies are ſo firmly glued together, that no operation can ſeparate the threads. The produce of many is by far too fine for any purpoſe in our manufactures, while that of another claſs is too coarſe.

Several

* Idem, Tom. I.

Several very laudable attempts have been made, but hitherto without any conſiderable degree of ſucceſs, to rear the ſilk worm in *Britain*. The public have lately been informed by a manufacturer in *Paiſley*, of his having prepared a web entirely of the ſilk produced by worms of his own rearing *: And in the tranſactions of the ſociety for the encouragement of arts, manufactures, and commerce, a number of very uſeful experiments are recorded with regard to the food and management of theſe inſects †.

Probably the want of a ſufficient number of mulberry trees has hitherto rendered ineffectual the efforts of our countrymen to introduce and rear any conſiderable quantity of ſilk worms. From the attempts that have already been made, it appears that the white mulberry is preferable to the black in feeding, and that the latter is to be preferred to the lettuce. Twelve cocoons, the produce of worms fed upon the white mulberry, weighed ſeven penny weights two grains; while an equal number of thoſe that had been fed upon the black mulberry weighed only ſix penny weight three grains: Six penny weights were obtained from the ſame number of worms fed upon common lettuce ‡.

Endeavours to produce raw ſilk in *Britain* ſeems the more worthy of encouragement, as that country appears to poſſeſs ſome advantages of which *Italy* and many of the ſilk countries are deprived. In *Italy*, the chryſalids ſoon come to life; and it is there neceſſary to deſtroy them, leſt, by eating their way out, they ſhould injure the ſilk. In order to effect this, they are collected and placed

* Vide Glaſgow Newſpapers, November 1791.

† The Rev. M. Swayne's Letters to Mr. More, Vol. VII.

‡ Tranſact. ubi ſupra.

placed in heated ovens, where the ſilk, without ſingular caution, is apt to be damaged. In our climate, where every progreſſion of the inſect tribe is ſlower, there is ſufficient time to wind off the ſilk without killing the chryſalis.

But beſide the injury that may be done to the ſilk in *Italy*, from the length of time which it is neceſſary to keep the chryſalis in theſe ovens, they are there obliged to ſuffer the moth to eat its way out of the largeſt cones, in order to have eggs from the moſt vigorous and healthy. Hence, they loſe all the ſilk of theſe cones; whereas, in this country, the ſilk may be gathered while the moths are preſerved. Thus, we ſeem to poſſeſs two ſtriking advantages, which may probably compenſate for the want of others which our climate has denied us.

Even the climate, however, of *England* is in ſome reſpects ſuperior to thoſe where ſilk is raiſed. In the ſouth of *France*, the froſts are often ſo intenſe as to kill the mulberry leaves after they are out. At that ſeaſon of the year, this is ſeldom the caſe in *South Britain*; which is alſo more free from lightning, and thoſe ſultry heats that have always been deemed prejudicial to the ſilk worm. From theſe conſiderations, the time may probably arrive, when our countrymen, by farther knowledge and experience upon this ſubject, may be enabled to avail themſelves of theſe advantages, and become entitled to a rank as diſtinguiſhed among the raiſers, as that which they have long held among the manufacturers of ſilk.

The ſilk worm, however, is perhaps far from being the only inſect of whoſe labours man might avail himſelf. There are many ſpecies very common, and immenſely fertile, that might be beneficially employed in procuring ſilk,

ſilk, did we know how to avail ourſelves of their labours. *M. de Reaumur* has mentioned ſeveral whoſe productions ought to be ſubjected to experiment by the manufacturer; and in ſome future period, ſome of theſe may be turned to account *.

Of many of the caterpillars belonging to this claſs of inſects, the ſilk, it muſt be allowed, is altogether unfit for our purpoſes: their coques are not only coarſe, but ſo ſcantily provided with ſilk, that the animal is obliged to join dry leaves, bits of wood, and other materials, in order to give ſtability to its edifice: Farther, many of them ſpin under ground, and their work conſiſts only of joining and connecting together, by means of their threads, different particles of earth, of which their houſe is compoſed. Theſe caterpillars, when kept by the naturaliſt, who waits for their phalænæ, muſt be ſupplied with earth in the boxes in which they are lodged; otherwiſe they will periſh, from not being able to conſtruct an edifice fit for their reception †.

The phalænæ, in their chryſalid ſtate, differ from the butterflies, in remaining for a much longer period before their metamorphoſes into perfect inſects is completed. Their form, too, is then different, being oblong, and not angular, like the chryſalid of the butterfly. Some remain in their coques for ſeveral years ſucceſſively; eſpecially if a cold damp ſituation has retarded their progreſs. So great is the effect of heat in precipitating their developements, that a moth in a warm expoſure may be produced from its chryſalid, even in the depth of winter.

After the phalænæ iſſue from their laſt covering, ſome of them are deſtitute of wings: Theſe are the females of certain

* Tome I. Mem. vi. † Barbut's Gen. Inſect. p. 189.

certain kinds, who, inſtead of wings, have only ſhort protuberances, altogether unfit for the purpoſe of flying. They have the appearance of large creeping animals of a different order, and can only be recogniſed for moths, by the ſhape of their antennæ, which are ſimilar to thoſe of the males, and by thoſe ſcales with which the body of theſe animals is covered.

The phalænæ, though leſs brilliant in colour than the butterflies, are ſome of them far ſuperior in ſize. The pavonia major of *Linnæus* is much larger than any ſpecies of the butterfly yet known: In bulk, it ſeems rather to reſemble a bird than an inſect; and in the richneſs of its clothing few of the feathered race can vie with it.

The three pavoniæ * have their name from thoſe rich and brilliant colours which are ſuppoſed to have ſome reſemblance to the gaudy dreſs of the peacock. Their wings appear covered with a gloſſy fur; and when ſpread, diſplay four eyes, decorated with vivid colours. Their caterpillar is alſo very beautiful; it is covered with hair, and it is the property of ſuch to produce thoſe ſcaly phalænæ, which are moſt diſtinguiſhed by the brilliancy of their colours.

The moths in general do not fly by day; yet in the ſummer evenings it is the light which attracts them into the dwellings of man: Then they are ſeen entering the rooms, and fluttering around the candles, where they often meet with a painful death. This fondneſs for light has ſuggeſted to the curious a method of catching theſe animals, by carrying a lanthorn into a bower, around which they all flock, and numbers are led into captivity.



* Syſt. Nat. Ord. III. Gen. iii. ſp. 7.

The phalæna of the ſilk worm, bombyx moris, frequents the leaves of the mulberry, upon which it is univerſally known to feed. It is one of thoſe inſects that has deſervedly attracted the notice of almoſt every naturaliſt; and to a particular deſcription of it we direct the reader in the note below *.

The moſt beautiful of the *Engliſh* inſects are the following phalænæ, viz the large emerald, or geometra papilionaria of *Linnæus* †. The thorax, wings and abdomen, are of a lovely pea-green; the wings are decorated with ſmall indented bars, and marginated with a fringe of golden yellow.

The peach bloſſom: The head and thorax of this inſect are dark brown; the ſuperior wings are of the ſame colour; but each is ornamented with five ſpots, of a pale pink, or roſe colour, and appear very like ſmall roſes painted on the wings: The abdomen and inferior wings are of a fine pale brown colour: The caterpillar feeds on raſpberry leaves; changes into a chryſalis in *June*, and in *July* comes forth a moth ‡.

The phalæna which in its larva ſtate is deſtructive to woollen cloth, is of a narrow oblong ſhape, having the wings raiſed towards the extremities: The head of this inſect is white; the ſuperior wings black towards the baſe, and white as they approach the tips: The inferior



* It is named in the Fauna Sweecica, phalæna pedinicornis, bombyx dicta, Aldrovandus deſcribes it, Inſect. p. 280 & ſeq. Johnſton, Inſ. Mouffet, p. 181. M. de Merian, Europ. Liſter in Goedart, p. 82. Charleton onom. p. 40. Albin, Engl. Inſects, p. 60. Reaumur, Tom. II.

† Syſtema Nat. Ord. III. Gen iii.

‡ Vide Harris's expoſition of Engliſh Inſects, p. 53, where many excellent drawings of the Engliſh inſects may be ſeen.

wings are of an aſh-colour; the body and the legs black, and the antennæ ſetaceous *.

Another moth, diſtinguiſhed by its deſtructive effects among woollen articles of apparel is thus characteriſed in the *Fauna Suecica*: The antennæ are ſetaceous, the tongue ſpiral, and the thorax marked on each ſide with a white ſpot. This animal is of ſmall ſize; the wings aſh-coloured; the head, legs, and the whole under ſide of the body are white †.

Theſe moths conſtruct the abode in which they reſide, of the grains of wool which they gnaw off the cloth: Their food is of the ſame ſubſtance; and what greatly increaſes the extent of their devaſtations is, that every ſtep they advance upon cloth, feeling themſelves incommoded by the wool in their way, they gnaw a ſmooth paſſage for themſelves, like a man with a ſcythe in his hand, cutting down the graſs of the meadow as he goes along ‡.

Theſe habits of the moth render them among the moſt deſtructive of inſects. The moſt coſtly articles of fur are thoſe which are not worn every day; and for that very reaſon they are moſt expoſed to their attacks. The methods for preventing their devaſtations may be reduced to the two following: either we muſt deſtroy the inſects, or render our clothes diſagreeable food for them.

The moths may be deſtroyed by oil, or the fumes of tobacco. And as wool is never ſubject to their depredations, ſo long as it remains upon the ſheep, the moſt likely

* Rai Inſect. p. 204. n. 98.

† Vide Reaumur, Tom. III. & Regne Animale, Tom. II. p. 162. n. 83.

‡ Reaumur, Tom. III. p. 5.

likely method of rendering it diſagreeable, is by reſtoring that greaſy ſubſtance which is taken from it by waſhing, and other proceſſes which it undergoes when manufactured †.

† Reaumur, Tom. III. Mem. iii.

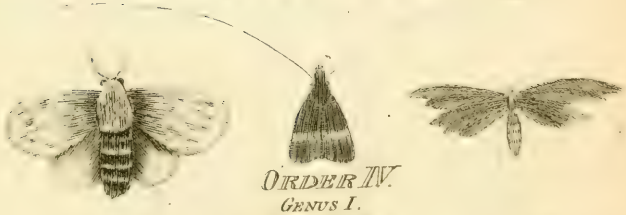
# CHAPTER V.

## Order IV.—*Neuropterous Insects.*

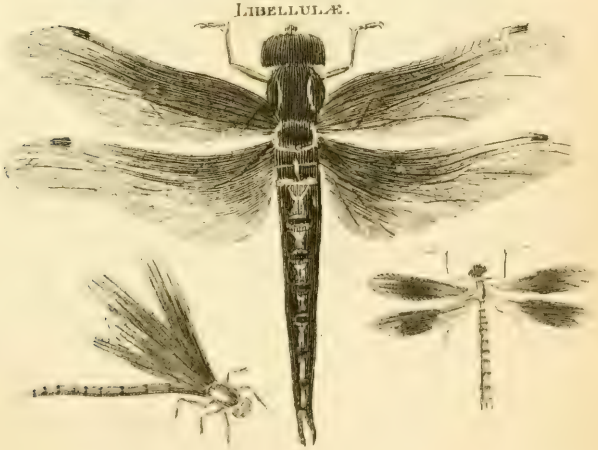
This order contains six genera of insects, all of which are distinguished by four naked wings, of a reticulated structure, and by appendices springing from the extremity of the abdomen, which is unarmed with a sting: These appendices are characteristic of the male sex in this order of animals.

Plate VII.

*Gen. III.*
PHALENÆ.



*ORDER IV.*
*Genus I.*
LIBELLULÆ.



## Genus I.—*Libellula. The Dragon-Fly.*

Of this tribe of large infects there are twenty-one different ſpecies remarkable by the formidable apparatus with which their mouths are armed. Their jaws are always more than two in number, and fitted for gratifying that voracity by which the libellulæ are diſtinguiſhed. The antennæ are ſhorter than the thorax; the wings are always extended, and, in ſome, meaſure ſeveral inches from tip to tip. The male is diſtinguiſhed by a kind of hooked forceps, by which the extremity of the abdomen is terminated †.

The dragon flies are univerſally known, from their large ſize, and the frequency with which they every where appear. The organs of generation are differently ſituated in the male and female of this tribe: In the former, they are placed upon the under ſide of that part of the abdomen which lies between the inferior wings; while, in the latter, they are found at the tip or end of the abdomen. The ſeaſon of love in all infects, from the brevity of their lives, is neceſſarily ſhort, but it is buſily employed. It is only the large infects, ſuch as the libellulæ, that are frequently ſeen celebrating the rites of *Venus*; and among them the operation is performed with a frequency and diſpatch that ſeems perfectly to correſpond

† Linnæus Syſt. Nat. Ord. IV. Gen. i.

ſpond with the tranſient nature of their exiſtence, and the numerous race they tranſmit to poſterity.

The addreſſes of the libellula to his female ſeem carried on in a rough and intrepid, but efficacious manner. He hovers about on the wing, till the object of his amours make her appearance; he then watches an opportunity of ſeizing her by the head with thoſe pincers with which his tail is armed. It is thus that the raviſher travels through the air, till the female, yielding to ſuperior ſtrength, perhaps to inclination, forms her body into a circle, that terminates at the genitals of the male, and thus accompliſhes the great purpoſe of nature. It is while theſe kind of rapes are perpetrating, that the libellulæ are ſeen coupled in the air, exhibiting the form of a ring *.

The female, when pregnant, retires to the ſide of a ditch or pond, when, by the aſſiſtance of a ſtick or reed, ſhe creeps, or lowers herſelf down, by moving backwards, till the tip of the tail is immerged about half an inch in the water; ſhe is then ſeen ſeized with a kind of trembling or ſhaking of the body, during which efforts ſhe depoſits a ſingle egg in the water; afterwards ſhe immerges her tail a ſecond and a third time, when the ſame operations are performed. The tail is withdrawn from the water, by contracting its annuli; and by the preſſure of theſe upon each other, the egg is gradually forced from the ovary to the extremity of the tail, from whence it is ultimately ſeparated, by ſhaking that part in the water.

The eggs thus protruded by the libellula are of a white colour, and oblong form, reſembling thoſe produced by the vomitoria or common blow-fly. The caterpillar which

* Barbut's Genera Inſectorum, p. 205.

which iſſues from theſe eggs, at firſt feeds on ſmall aquatic inſects, gradually acquiring more voracity and boldneſs in the purſuit, in proportion as its ſtrength increaſes, at length it becomes ſo inſatiable that it is ſaid to devour even thoſe of its own kind †.

The form and colour of theſe worms are extremely diſguſting: They are ſuppoſed to have gills like fiſhes; and beneath the head is placed an inſtrument excellently adapted for ſeizing and holding their prey. It is furniſhed with a forceps at the end, and can be advanced or drawn back with all the agility of the human hand.

The caterpillar remains in the ſame ſtate for nearly twelve months before it has attained to its full ſize: When the period of transformation has arrived, the worm repairs to the margin of its pond in queſt of a convenient place of abode during the ſeaſon of its inaction. It there attaches itſelf to a plant or piece of dry wood; and the ſkin, which has gradually become parched and brittle, at laſt ſplits oppoſite to the upper part of the thorax. Through this aperture the winged inſect quickly puſhes its way; and being thus extricated from confinement, begins to expand its wings, to flutter, and finally to launch into the air, with that gracefulneſs and eaſe peculiar to this majeſtic tribe ‡.

No particular time ſeems appointed for the metamorphoſis of the libellula into its winged ſtate; the different ſpecies are continually emerging from the water from *April* to *Auguſt*: For as the times of copulation are various and frequent during the whole ſummer, ſo the larvæ or caterpillars are found of different ſizes, according to their age. The ſmaller kinds, however, generally make

† Harris Expoſit. p. 51. ‡ Barbut, ubi ſupra.

make their appearance before the largeſt; becauſe, from breeding in ſhallow water, they ſooner feel the influence of the ſun on the approach of ſpring.

The manners of theſe inſects muſt no doubt be greatly altered by a change, which not only confers upon them a new form, but introduces them into a different element. The complete inſect, in its winged ſtate, however, ſtill continues to purſue the ſame food, and remains inſectivorous. The lepidopterous inſects, the butterflies, and phalænæ are deſtined for the ſupport of the larger libellulæ; they are a part of thoſe numerous tribes that are appointed to confine thoſe prolific genera within due bounds †.

The libellula grandis is the largeſt of this genus found in *Britain*, and is perhaps not inferior in bulk to any inſect which this country produces: The fore part of the head is yellow; the eyes brown, and ſo very large, that they meet upon the top of the head. The thorax is dun coloured, with two oblique bands on each ſide, of a lemon colour. The abdomen, which is very long, is likewiſe of a deep buff colour, often ſpotted with white upon the top and bottom of each ſegment; the ſmall appendices which terminate the abdomen, are in this ſpecies very long; the wings have more or leſs of a yellow complexion, and are diſtinguiſhed by a brown ſpot on the exterior edges ‡.

The libellula forupata § is another large inſect of this genus, which expands four inches and an half. The noſe is yellow, having a black line on the prominent part; the thorax is black, with ſeveral broad yellow ſtripes,

2 two

† Harris Expoſit, p. 51. ‡ Barbut, p. 206.
§ Syſt. Nat. Ord. IV. Gen. i. No. 11.

two of which appear on the front, and two others between the ligaments of each pair of wings; the abdomen is alſo black, having two ſtreaks reſembling a creſcent on each ſegment; the wings are tranſparent, and, but for a ſlight tinge of amber, almoſt white *.

The libellula whoſe body is of a ſhining green, and the wings of a gilded brown, is ſmaller than either of the foregoing, and is thus characteriſed by Mr. *Ray* †: The body is green and azure; the wings adorned towards the middle each with a large ſpot, of a deep blue, inclining to black. The feet of this inſect are black, and the wings have no ſpot on their exterior margin. From the brilliancy and richneſs of its colours, it has been called the king's fiſher; it frequents little rivulets of water, overſhaded with buſhes ‡.



* Harris's Expoſit. p. 78. † Inſect No. 9.
‡ Harris's Expoſit. p. 99. fig. 1.

## Genus II.—*Ephemera.* *The Day Fly.*

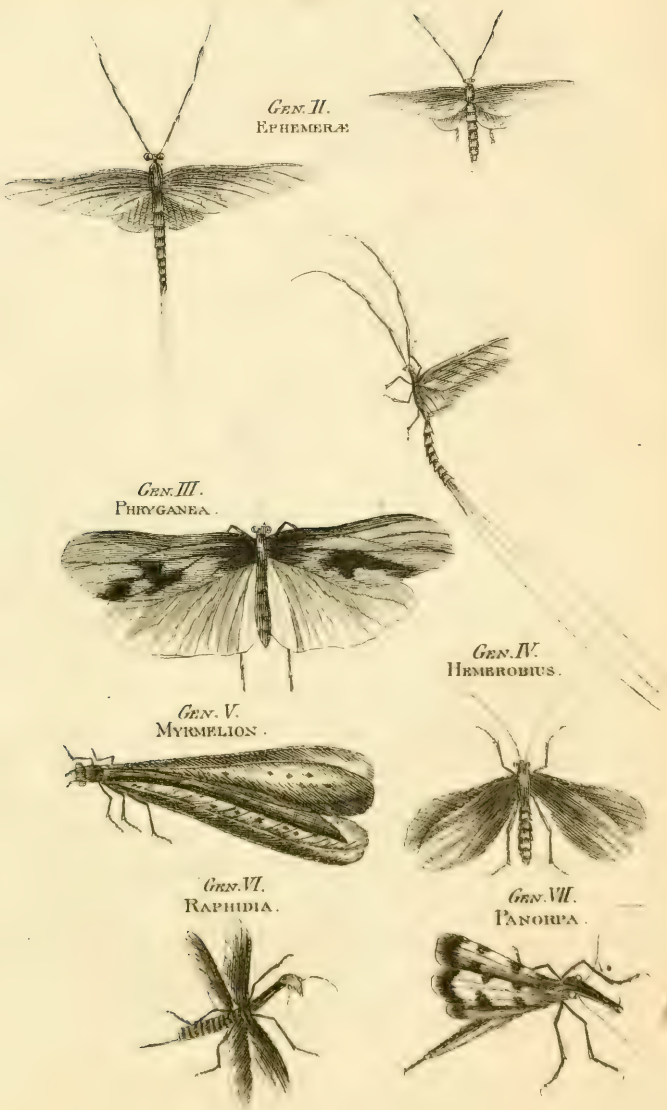
The mouth of this genus has neither teeth nor palpi; the insects which compose it have two, sometimes three stemmata, situated above the eyes, and larger than is usual in other insects. The wings, when the animal is at rest, stand erect, the upper much larger than the inferior pair; the tail is furnished with an indefinite number of setaceous appendices †.

The insects of this genus have been denominated ephemeræ, or day flies, from the shortness of their lives; but the life of a day is in proportion to that of several animals of this class, what the lives of the antedeluvian patriarchs were to ours. The period allotted by nature for the existence of certain ephemeræ is only a few hours; of some, even less than an hour. To some insects, indeed, that bear the generic characters of ephemeræ, she has been more indulgent; for these are destined to see more than one revolution of the sun ‡.

All the day flies are produced from hexapodal worms, which are afterwards transformed into chrysalids, of a form nearly resembling their own; like the parent worm, they walk on the same number of legs. Both the worm and the chrysalis are aquatic, and are provided with gills like

† Syst. Nat. p. 906. ‡ Reaumur, Tome VI. p. 23.

Plate VIII.


Gen. II.
Ephemeræ
Gen. III.
Phryganea.
Gen. IV.
Hembrobius.
Gen. V.
Myrmelion.
Gen. VI.
Raphidia.
Gen. VII.
Panorpa.

like thoſe of fiſhes, and probably deſtined to ſerve the ſame purpoſe.

They are ſeen arranged along each ſide of the abdomen, one on every ſegment, from the firſt to the ſixth or ſeventh. When the inſect is at reſt, theſe branchiæ are ſeen moving with great rapidity; and from their poſition, *Reaumur* has diſtributed the chryſalids of ephemeræ into three diſtinct claſſes *.

Some of theſe chryſalids walk or ſwim up and down in the water, attach themſelves to plants, or conceal themſelves below the ſtones: Others have the firſt pair of feet formed for digging into the ground, and beſides, are provided with two inſtruments on the forehead, ſtill better adapted to that purpoſe: with theſe, each animal digs itſelf a hole on the river bank, where it conſtantly reſides. The brinks of the *Marne* and the *Seine* in *France* are ſeen thickly perforated by theſe animals: The holes thus excavated are generally nearly on a level with the ſurface of the water, and have commonly two apertures; one by which the worm enters, and another by which it returns.

Theſe animals, while they remain in theſe ſubterraneous retreats, offer but few materials to the naturaliſt who would record their hiſtory: Though many of them remain there for two years, and feed upon the earth in which they are lodged, yet they are effectually concealed during all that period from his obſervation. Probably the moſt intereſting incidents of their lives are thoſe which happen in our view, and are confined to the narrow ſpace of a few hours. Their ſtory becomes then eventful; for in that ſhort period they are transformed into flies, the fe-



* Tome VI. mem. 11.

males impregnated, and the eggs depoſited; and theſe functions are no ſooner over, than the active beings who performed them finiſh their operations for ever *.

On the banks of the *Sienne* and the *Marne*, in the vicinity of *Paris*, the ephemeræ exhibit a ſingular ſpectacle for ſome days about the middle of *Auguſt*. For ſeveral hours after ſunſet, they riſe in ſuch vaſt multitudes, that they appear like the flakes preſſing upon each other in a heavy fall of ſnow. By and by, the whole ſurface of the earth is covered with the ſwarms that have fallen upon it, after having finiſhed their ſhort exiſtence.

The chryſalids that remain under the water begin their transformation in the evening, and complete it by eight or nine o'clock; an operation painful and difficult to other inſects, is with them performed with great celerity and apparent eaſe. No ſooner has the chryſalis reached the top of the water, than its priſon burſts open, and the winged ephemera ſoars into the air. Millions after millions are thus conſtantly taking wing, till the air becomes darkened with their numbers: They are in that element but an inſtant, when abundant ſhowers of them fall back to the ground.

The females, after their fall, are buſy in performing the laſt function of their lives, which is, depoſiting their eggs. Such as have dropped upon the ground leave them there; while thoſe that have tumbled into the river produce two ſeparate cluſters of ova, each containing no leſs than three hundred and fifty. All this is the work only of a moment; for other inſects are not ſooner delivered of a ſingle egg, than the ephemera of ſeven hundred.

Some

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* Reaumur, Tome VI. p. 43. Preſ.

Some naturaliſts have pretended, that theſe eggs were all impregnated, like thoſe of fiſhes, by a kind of ſperm ejected from the body of the males. This opinion, however, is combated by *Reaumur* *, as being attended with many difficulties. That naturaliſt, by the help of a lighted torch, has examined theſe animals narrowly in their winged ſtate; and although that method of ſurveying inſects, whoſe numbers occaſion ſo much confuſion, be uncertain, he aſſerts, that he obſerved them engaged in ſhort copulations; an aſſertion the more probable, ſince, if the ephemeræ copulate, that act behoved to be more inſtantaneous than in any other race of beings.

Another ſpecies of the day fly is ſeen to caſt a ſkin, even after it has arrived at its winged ſtate: Thus, however ſlender their wings might at firſt appear, they muſt, as well as the whole body, have been enveloped in a coat which the animal then drops †.

The ephemera *vulgata*, or common day fly, is the largeſt of theſe inſects with which naturaliſts are yet acquainted; it carries at the extremity of the abdomen three brown threads, nearly of equal length with the body, which is all over brown. The wings are ornamented with brown veins, which form a net-work.

In *Carniole*, a province of *Germany*, this ſpecies is ſo numerous, that the peaſants think they make a bad harveſt of them, if they do not unload upon their land many carts filled with theſe inſects. They make excellent manure; but the number of animals of ſo ſmall a ſize neceſſary to ſupply the quantity, muſt exceed the power of imagination to conceive.

* Vide Biblia Naturæ. † Reaumur, Tome VI. Pref.

## Genus III.—*Phryganea.*

These inſects, as well as the laſt, are of a ſmall ſize, and are at firſt ſight eaſily diſtinguiſhed by the antennæ, which are longer than the thorax, or even the whole body. The mouth is without teeth, but furniſhed with four palpi; the four wings are incumbent; the under ones, when unfolded, are very broad in proportion to the ſize of the animal that wears them *.

There are twenty-four ſpecies ranged under this tribe, which *Linnæus* has divided into two families; the firſt characterited by having the ſetæ which ſpring from the extremity of the abdomen truncated like the beards of an ear of corn; and the ſecond, by having the abdomen ſimple, without appendices.

The phryganeæ, before they become inhabitants of the air, have, like the ephemeræ, been aquatic animals; their apartments in the water are ſingularly conſtructed; their form is that of a tube, the inward texture of which is ſilk, while it is outwardly compoſed of ſand, ſtraws, or chips of wood. When the animal within finds its chryſalid ſtate approach, it ſtops up the ends of this tube with threads of a looſe texture, through which the water may penetrate, while it prevents the approach of voracious inſects.

The

* Syſtema Naturæ, Ord. IV. gen 3.

The precautions of theſe aquatic larvæ, in ſecuring themſelves in theſe retreats, are alſo neceſſary to protect them from fiſhes, who are very greedy of them. Some of the phryganeæ of ſtagnated water, ſuch as lakes and ponds, cut the water lentil in regular ſquares, from which they conſtruct their edifices. The common trout is one of their greateſt enemies; and many other fiſhes covet them ſo eagerly, that, when ſtripped of their cruſt, they make excellent bait.

The phryganea bicauda of *Linnæus* frequents equally the banks of rivers and of ſtanding pools; the wings are a third longer than the body, narrow at the top, and broad below, and reticulated with brown veins; the colour of this inſect is a dark brown, with a ſingle longitudinal ſtreak paſſing acroſs the head and thorax; the antennæ are long, filiform, and of the ſame colour with the legs and body *; the appendices of the tail are of equal length with the antennæ.

The phryganea ſaltatria is one of the ſmalleſt ſpecies of this genus; the wings are decorated each with a green and white ſpot †; the antennæ are longer than the body; and when examined with a microſcope, appear velveted; the wings are of a bright colour; the ſmall veins by which they are reticulated being white at the baſe, and blackening towards their extremity ‡.

* Barbut's Gen. Inſect. p. 216. † Fauna Swecica, phrygan. ſpec. 31.
‡ Regne Animale, Tome II. p. 117.

## Genus IV.—*Hemerobius.*

This tribe of infects have obtained the name of hemerobii from the fhortnefs of their lives, although they continue in their winged ftate longer than a day. This genus is diftinguifhed by having the mouth armed with two teeth and four palpi; the wings hang down, without being folded; the antennæ are fetaceous, advanced before the head, and longer than the thorax, which is convex *.

Nature feems to have fpread plant lice upon almoft every plant, for the mantainance of thoufands of her offspring. In their larva ftate, the hemerobii are great devourers of thefe animals; and from that circumftance they have obtained the name of lions of plant lice †. Even after their transformation, the hemerobii retain their carnivorous habits: Not fatisfied with making war upon the plant lice, who tamely fuffer themfelves to be devoured, they do not fpare thofe of their own kind.

The moment thefe infects enter upon life, they find themfelves, by the precaution of their anceftors, fituated among thoufands of fmall animals, which, without any effort, they deftroy. In lefs than a minute after the plant loufe has been feized, the whole vifcera and juices are fucked from its body. Some fpecies make a covering for their body of the carcafes which they have thus emptied, and carry them about as trophies upon their backs.

The

* Syft. Nat. p. 911. † Reaumur, Tom. III. mem. 11.

The eggs of the hemerobius offer a curious ſpectacle to the obſerver, and for a long time were deemed paraſitical plants. Each of them is ſupported upon a long pedicle, reſembling the ſtalk of a plant, of which the egg appeared to be the flower. In this form they are ſeen in cluſters upon leaves, where, as ſoon as they are hatched, they find ſubſiſtence among the ſurrounding plant lice.

In about fifteen days, the larva attains to its full growth, when it weaves to itſelf a ſmall white ſilken cod of a cloſe texture: there the hemerobius lodges about three weeks, till its metamorphoſis into a winged animal is completed: If, however, the cod has not been ſpun till Autumn, it remains in it till Spring, when it is tranſformed. The flight of theſe inſects is ſlow and heavy; ſome of them have an excrementitious ſmell.

The hemerobius perla of *Linnæus* is one of the moſt beautiful animals of this tribe: The eyes are golden, and the whole body of a yellowiſh green *; the wings are very large, diaphanous, and of nearly the ſame colour with the body; it inhabits garden plants, and when touched, has the ſmell of ordure †.



* Rai Inſect. p. 274. † Vide Mouffet, p. 62. & Grew, muſ. p. 156.

## Genus V.—*Myrmeleon. The Lion Ant.*

The mouth of this voracious race is armed with jaws, two teeth, and four palpi. In the male ſex, the tail is furniſhed with a kind of forceps, formed by two ſtraight threads; the antennæ are in the ſhape of a club, and of equal length with the thorax

The lion ant, concerning which ſo much has been ſaid by naturaliſts, is of five kinds, all diſtinguiſhed by an uncommon voracity, and cunning in ſecuring their prey; their habits of rapacity ſeem born with them; and during their whole lives they are ſupported by the game which they catch. At firſt ſight, theſe animals ſeem but ill fitted for their manner of life: The moſt unwieldy inſect can eaſily eſcape from them; for they cannot advance upon it a ſingle ſtep; all its progreſs in walking being backwards; by ſtratagem, however, this lion maſters inſects far ſuperior to it in ſtrength. In the looſe ſand it digs a hollow reſembling a funnel, where it takes its ſtation at the bottom, every part being concealed except the forceps with which the head is armed. This inſtrument, which it can open or ſhut at pleaſure, is happily conſtructed for ſeizing and penetrating the hardeſt inſect; and unhappy is the animal, who, in purſuing its journey, ſtumbles into this cavern. In vain it endeavours to ſcramble up by the edges, which are continually giving way under its feet; it tumbles to the bottom, where it is pierced by the forceps of the lion ant lurking below.

If

If the inſect be ſmall, and the grains of ſand, notwithſtanding the declivity of the funnel, do not give way under its feet, the myrmeleon has another invention by which he renders himſelf maſter of his prey: With his head, which is flattened, he throws up repeated ſhowers of ſand from the bottom of the funnel, which falling upon the ſides, force down the inſect till it comes within reach. The fatal inſtruments with which this animal ſeizes its prey, are each a ſort of mouth or trunk, by which it ſucks out the whole intrails before it is drawn out of the body *.

When the lion ant has attained its full ſize, it conſtructs for itſelf an edifice, the external parts of which are particles of ſand or earth combined together by ſilken threads: the interior cavity is lined with pure ſilk, white and gloſſy like ſatin. Within this ball the myrmeleon is changed into a chryſalis, of a curved or ſemicircular ſhape, diſplaying all the parts of the perfect inſect that is ſoon to iſſue from it.

After the chryſalis burſts, the winged inſect which makes its eſcape is of a gray colour, with a long ſlender body, reſembling the libellula. In this country, the myrmeleon is very ſcarce; a few, however, are found to breed among the looſe earth at the bottom of walls which have a ſouth expoſure. In that dry, pulverized, and ſandy earth, their eggs are protected from rain, till they are hatched by the ſun. *Vallisnieri* and *Poupart* firſt gave the hiſtory of the lion ant; that of the former is in the form of a dialogue between *Malpighi* and *Pliny*, in which the modern informs the ancient naturaliſt of the ſingular manœuvres and metamorphoſis of theſe animals.



* Reaumur, Tome VI. mem. x.

Externally, the lion ant preſents no features that are remarkable. The head is broad, of a brown colour, ſpotted with yellow: On each ſide are placed two large eyes, and beneath them the antennæ, thickening towards the point, and ſhorter than the thorax. The neck is longer than that of moſt inſects, and can be ſtretched or ſhortened at pleaſure. The thorax is of a dirty white, and upon the annuli which compoſe it are ſeen by the microſcope, the organs of reſpiration †.

† Reaumur, Tome VI. mem x. p. 339.

## GENUS VI.—*Panorpa. The Scorpion.*

FORMERLY there was only one ſpecies of theſe animals known, till *Linnæus* diſcovered four different kinds, which he has enumerated in the lateſt editions of his ſyſtem of nature. They are all diſtinguiſhed by a cylindrical proboſcis, of an horny tranſparent ſubſtance; by two palpi, and three ſtemmata above the head. The tail of the male ſex is furniſhed with a weapon reſembling the dart of a ſcorpion; a circumſtance from which almoſt all naturaliſts have given it that name †.

The formidable inſtrument with which the tail of the male ſcorpion is armed, is not formed for any hoſtile purpoſe; it is uſed by him in laying hold of his female during their amorous embraces.

There are varieties of the common ſcorpion; that moſt frequent is of a dark brown, and yellow upon the ſides. The tail is formed by the three laſt ſegments of the abdomen, and is of a maroon colour; the wings, which are as long as the body, are diaphanous, and reticulated, with fibres and ſtreaks of a brown colour. There are ſome

† Vide Aldrov. Mouſſet, p. 62 & Friſch, p. 29.

ſome varieties of this ſingular animal: Inſtead of the ſtreaks on the wing, we find ſome with a ſingle tranſverſe ſtripe of black irregularly placed acroſs the wing; others are found with their wings entirely white, excepting the tips, which are black.

## Genus VII.—*Raphidia**.

This tribe is characterised by two teeth, a flat head, of a horny substance, four palpi, and three stemmata; the antennæ are filiform, and as long as the thorax; the anterior part of which is lengthened out like the neck of a bird. The tail of the female is terminated by an appendice resembling a flexible crooked bristle †.

There are only three species of this genus yet discovered; the first of which is termed the ophiopsis, from the figure of its head and long thorax. Its form is the most singular, perhaps, of any animal in this class of beings. The shape of the head is broad before, and narrow where it joins the thorax, resembling a heart; it is flat, smooth, and black like horn: the thorax is of the same colour, narrow, and cylindrical: the antennæ are setaceous, and composed of many articulations: the abdomen is brown, marked with white transverse lines. the wings are radiated and diaphanous; the exterior edges in some subjects have each a black spot: the anus terminates in a curvated setaceous bristle, about half the length of the abdomen ‡.

* Barbut's Gen. Insect. p. 227. † Syst. Nat. p. 916.

‡ Regne Animale, p. 112.

# CHAPTER VI.

## Order V.—*Hymenopterous Insects.*

This order contains all the bees, hornets, wasps, and ichneumons, insects which are distinguished from those which we have already reviewed, by possessing a sting, and four membranous wings. Some of them the industry of man has turned to advantage, by reducing them into a domestic state, while the greater part still remain the free servants of nature, and may be regarded among the most inveterate enemies which men have to dread among this race of animals.

Plate IX

ORDER IV

GEN. I
CYNIPS

GEN. III.
SIREX.

GEN. II.
TENTHREDO.

GEN. IV.
ICHNEUMON.

GEN. V.
SPHEX.

GEN. VI.
CHRYSIS.

GEN. VII.
VESPÆ.

## Genus I.—*Cynips*. *The Gall Fly.*

The mouth in this genus is armed with jaws, but has no proboſcis; the ſting is ſpiral, and moſt frequently concealed within the body.

Thoſe innumerable and various excreſcences which are ſeen upon the leaves, branches, and roots of trees, are all the productions of different kinds of inſects. Of theſe, ſome ſo nearly reſemble the natural productions of the plants, that they are ſometimes taken for their fruit or their flowers: A particular kind of ivy produces galls that are actually eaten as fruit by the peaſants in ſome parts of *France*; and in *Conſtantinople*, there are ſome of theſe productions brought to market for ſale *.

Some of theſe excreſcences have within a ſingle large cavity, in which ſeveral inſects live and aſſociate together: Others have a number of ſmaller cavities, with communications between them; a third claſs contain a variety of ſeparate cells, ſometimes a hundred, each occupied by a ſingle inſect, which has no communication with the reſt. Theſe productions are alſo of various ſizes, forms, and conſiſtency; ſome are ſpongy, while others are hard like a nut. Of the latter kind, thoſe are beſt known which are imported from the *Levant* for the purpoſe of dyeing cloths.



* Reaumur, Tom. III. Mem. xii.

All theſe apparently monſtrous productions are occaſioned by the puncture of inſects when depoſiting their eggs, or by their bite when collecting food; in both caſes, the animals ſubſiſt upon it; and the more they eat, the more vigorouſly does the protuberance continue to grow, till at laſt it forms a ſort of impenetrable fortreſs, to protect its inhabitants till they have gone through their different metamorphoſis, and at laſt taken wing. But the beſt concerted ſchemes of inſects, and of man, are unequal to ſecure either from every accident that may occur. Impenetrable as the habitation of the gall fly may appear, its walls are often perforated by other inſects, who depoſite eggs there, that are ſoon to become rapacious worms, and to lay the dwelling waſte.

The ancient opinion concerning the animals found in theſe receptacles was, that they were ſpontaneouſly produced from the rotten wood of the plant. Afterwards, it was believed, that the roots of plants had the power of ſucking up, along with ſap from the earth, the eggs of inſects, and that theſe were animated as ſoon as they ſtopped circulation through the fibres of the tree. Even the intrepid *Rhedi*, who combated the prejudices of his age with ſucceſsful boldneſs, had recourſe to a kind of vegitative ſoul in plants, by which he accounted for the production of theſe animals. *Malpbigi* at laſt explained their true origin, from eggs depoſited there by thoſe of this kind. The ſame naturaliſt gives an ingenious account of the formation of theſe excreſcences themſelves, by means of a liquor depoſited by the fly, mixing with the ſap of the tree, and cauſing a fermentation at the part. The ſimple extravaſation of juice from the wounded plant,

plant, is however, ſufficient to account for the largeſt galls that have yet been obſerved *.

The cynips quercus folii †, is of a burniſhed ſhining brown colour; the antennæ are black; the legs and feet of a cheſnut brown; and the wings white, without marginal ſpots. Thoſe ſmooth round galls that are ſeen under the oak leaves, are the birth places of theſe inſects: commonly a ſingle one is found in each gall. Inſtead of the natural inhabitant of this gall, a larger inſect of a brown colour is ſometimes ſeen to proceed; this is the ichneumon, who is neither the builder nor the legitimate owner of the dwelling, but a paraſite produced from an egg depoſited there by his progenitors.

Of all the trees with which we are acquainted, the oak affords food and an habitation to the greateſt number of inſects. There are above fifty different ſpecies that in this country inhabit that plant, and probably in warmer climes the numbers of its tenants is much greater. The *Norway* ink, ſo celebrated for its colour and permanency, is the produce of a gall in that country, ſimilar to that ſeen upon our oaks in the month of *June*. The fly which produces it is perhaps the ſame ‡.

The gall fly of the roſe, cynips roſæ, is found on the gall of that ſhrub, and is diſtinguiſhed by the black protuberances of the antennæ; the abdomen below is ferrugineous, the feet yellow, and the wings without ſpots §.

* Reaumur, Tom. III.
† Syſt. Nat. ſpec. 5.
‡ Barbut, p. 234.
§ Fauna Swecica, No. 938.

## Genus II.—*Tenthredo. The Saw Fly.*

The family of ſaw flies have two jaws, but no trunk or proboſcis. Their ſting, which is almoſt hid by the abdomen, is of a ſingular ſtructure, being compoſed of two plates, and dentated like a ſaw. The abdomen is cloſely united to the thorax, without the intervention of a ſmall ſtalk, as in the former and ſucceeding genera.

From the ſhape of the antennæ, the tenthredines have been arranged into ſix tribes, conſiſting of about thirty-nine different ſpecies. The moſt remarkable fact in their hiſtory ſeems to be the application of her ſaw by the female, in cutting out a ſpace in the twigs or buds of trees to contain her eggs: The whole proceſs is performed with great ingenuity; and from the tameneſs of theſe animals, may eaſily be obſerved.

The eggs thus depoſited have the peculiar property of increaſing their ſize every day, till the young worms are ready to burſt from them. The worm of the tenthredo has often been taken for the ſilk worm; an animal which it nearly reſembles, except in the feet, which are more numerous: Like the ſilk worm, too, the young tenthredo conſtructs a cod in which it may undergo its laſt transformation; and its edifice conſiſts of two coats of ſilk, the external coarſe and ſtrong, the interior of a finer ſubſtance *.

The

* Reaumur, Tom. V. Mem. iii.

The tenthredo femorata is, as the name imports, burdened with two large thighs; the whole inſect is black, except the antennæ and tarſi of the feet, which are yellow †.

The tenthredo luctuoſa alni. This quiet, melancholy, and beautiful fly is found among alder plantations, and is often fatally entangled in the clammy juice that iſſues from their leaves. The head and trunk are of a fine yellowiſh brown; the antennæ a more duſky ſhade of the ſame colour, and the eyes blue: The body is coal black; the ſegments of a browniſh yellow; the wings are of a pale yellowiſh brown, with little yellow riſings upon their fibres, and a margin of yellow ‡.

There are no leſs than fifty-five ſpecies of the tenthredo enumerated in the *Linnæan* ſyſtem; but the *Swediſh* naturaliſt ſeems himſelf to ſuſpect, that ſome kinds are twice mentioned. Colour, though an obvious, is no certain character of inſects. In ſome, it differs with the ſeaſon, in others, with the ſex; and in all it glows according to the creature's health and vigour.

† Syſt. Nat. ſpec. 1. ‡ Barbut's Gen. Inſect. p. 238.

## GENUS III.—*Sirex. The Tailed Wasp.*

THE animals of this genus are not ſo numerous nor diverſified as the laſt, but are greatly ſuperior in ſize; the mouth is armed with two ſtrong jaws; the palpi ſhort, and articulated; the antennæ are filiform, and conſiſt of near thirty articulations; the ſting is long, ſtiff, ſerrated, and projecting beyond the abdomen; the wings are plain, and of the ſhape of a lance; the abdomen is ſlender, terminating in a point towards the ſting †.

Of the ſeven different kinds of ſirices, the gigas of *Linnæus* is the largeſt; the male, indeed, as is frequently the caſe, is one third leſs in ſize than his female, and has neither ſpine nor ſting at his extremity: That inſtrument, however, is formidable in the other ſex; it conſiſts of three laminæ; two at the ſides, which ſerve for ſheaths, and one in the middle, ſomewhat ſerrated, which is the real ſting.

The wings of this ſpecies are large, yellow, and veined; the thighs ſhort, and black; and the legs, as well as the tarſi, are yellow; the antennæ are of the ſame colour, and are inſerted into a black head, which has apparently



† Syſt. Nat. Ord. V. Gen. 3.

parently four eyes. What appears to be the ſecond pair of eyes is only two large yellow ſpots behind the other. The belly is cylindrical, and conſiſts of nine different ſegments, ſome of a black, and others of a yellow colour *.

* Barbut's Genera Inſectorum, p. 242.

## Genus IV.—*Ichneumon.*

This genus contains a numerous liſt of inſects, whoſe manners appear ſingular, even amidſt the wonders which this claſs of beings is continually diſplaying. It contains upwards of ſeventy different ſpecies, all characteriſed by the antennæ, which have more than thirty articulations; by the mouth, armed with jaws, but without a tongue; and by the abdomen, which is joined to the body by a pedicle or ſtalk, and which terminates in a projecting ſting, incloſed in a cylindrical ſheath †.

We have already had occaſion to obſerve one ſtriking peculiarity in the manners of ſome inſects of this genus, who make their way into the body of the caterpillars of different kinds, and there depoſite their eggs. It is from the ſignal ſervices which they perform, in deſtroying caterpillars, plant lice, and other inſects, that they have derived their name: Theſe animals are devoured by them, as the genuine ichneumon, or mangouſte, deſtroys the crocodiles.

As the ſpecies and varieties of the ichneumons are prodigiouſly numerous, ſo their manners are extremely diverſified: In the general outlines of their character, they all agree, being remarkable for their depredations among the inſect tribes. In ſome, the female is furniſhed

† Syſtema Nat. Ord. V. Gen 4.

ed with a wimble, attached to her abdomen; and with this inſtrument, though delicate, ſhe is capable of piercing through lime and plaſter. The larvæ of waſps and maſon-bees are the devoted prey of this ſpecies, which no ſooner eſpies one of their neſts, than with its wimble it perforates the mortar of which it is conſtructed. This operation, which is performed with ſingular dexterity, is no ſooner finiſhed, than it depoſits its eggs in the inſide, to the number of one, two, and ſometimes more. Some are contented with gluing their ova to the ſkin of a caterpillar, while others penetrate through it, and depoſit the egg in its body †. The ova hatched within the caterpillar, after being quickened into life, preys upon the inteſtines of that animal, without, however, deſtroying its vitals. Upon the life of the one animal that of the other ſeems to depend; and the ichneumon ſpares the caterpillar upon which it feeds, till it is about to enter into its chryſalis ſtate. In the mean time, the caterpillar in which it is encloſed is apparently healthy, and prepares to undergo the ſame transformation; a function which it is ſeldom able to accompliſh, becauſe the interior parts eſſential to the butterfly, though not to the worm, are deſtroyed ‡. Often theſe caterpillars, which have been the cradle of thirty or forty ichneumons, are ſeen fixed to the bark of a tree, as if they were ſitting upon their eggs; and it is diſcovered that the larvæ which were within their bodies have ſpun their threads, with which, as with cords, the unhappy caterpillar has been faſtened down, and periſhed miſerably.

The eggs of the ichneumons which have been ſimply agglutinated to the outſide of the larvæ, remain not long



† Reaumur, Tome II. Mem. xi. ‡ Idem, Tom. II. Pref.

in that poſition; for the young animals produced from them eaſily make their way into the body of the caterpillar on which they were placed.

Various are the ſizes of this carnivorous race: Some are ſo ſmall, that the plant louſe, the curculio, or the ſpider's egg, is made the cradle for their young; and all the inſects upon which they fix undergo the ſame fatal deſtiny, ſooner or later periſhing by their depredations. Thoſe carcaſes of plant lice which are ſeen motionleſs on the roſe-tree leaf, have been each the habitation of a ſmall larva, which, after having devoured the intrails of the plant louſe, has performed its metamorphoſis under the empty ſkin, from which it has afterwards ſallied forth a winged ichneumon.

But though many of theſe inſects are ſo extremely minute, there are others, which, from their ſize and intrepidity, are formidable to the ſpider. Many of theſe challenge that animal to open combat, and having run him through with their ſtings, tear him to pieces; thus avenging the whole race of flies of the injuries they ſuffer from that moſt dreaded enemy of their kind.

Ichneumon aphidum. This inſect is almoſt wholly black; the abdomen, towards the baſe, and the feet, are yellow; the antennæ are black. This ſpecies, when about to depoſit its eggs, bends the abdomen till the anus nearly approaches the thorax, and thus penetrates into the anus of the plant louſe, in which it lodges its progeny †.

The paraſitic ichneumon ‡. The larva of this inſect adheres to the body of a caterpillar, upon which it feeds. The

† Regne Animale, Ord. V. Gen. iii. ſpec. 3.

‡ Vide Actes d'Upſal, 1736, p. 29, N. 11.

The head and the antennæ are black, the latter longer than the body; the feet are yellow *.

The black ichneumon †. The antennæ, head, thorax, and abdomen of this ſpecies are all black: it is farther diſtinguiſhed by the three filiform appendices of the tail, which are longer than the body, and that in the middle of a red colour. It frequents the meadows and gardens ‡.

* Derham's Phyſico Theol. l. 8, c. 6.

† Veſpa Ichneumon tota nigra, Rai Inſ. p. 256.

‡ M. de Geer, Vol. I. p. 703.

## Genus V.—*Sphex. The Savage.*

The mouth of this tribe is armed with jaws, but has no tongue; the antennæ have ten articulations, and the wings are extended, and laid horizontally upon the back; the ſting lies concealed within the body.

This genus contains inſects, perhaps the moſt fierce and rapacious of this claſs of beings. The ſavage, or ground bee, does not feed upon honey, or accommodate its young with that kind of proviſion. They attack inſects much beyond their own ſize, and that whether they are defenceleſs or armed; for they are provided with ſtrong jaws, and a ſting poiſoned with a liquor fatal to every animal they engage. The ſavage ſeizes boldly on the inſect he attacks, and gives it a ſtroke of amazing force. After this firſt encounter, he falls down, as if he had himſelf received the mortal blow; but it is only to reſt from his fatigue, and to obſerve the effects of his proweſs. By and by, the wounded animal dies; and while yet palpitating with life, the ſavage devours thoſe parts which he finds moſt palatable, leaving the greater part entire.

It is thus that the ſphex riots in the blood of hundreds of inſects; and his family is no ſooner increaſed, than the carnage becomes proportioned to the number of young he has to ſupport. After the female has depoſited her eggs in the bottom of a cell dug in the ground, or in the mud

mud wall of a cottage, the whole apartment is crammed with multitudes of living and dead infects, deſtined to be the food of the future progeny. Thus their houſes, like the renowned caves of the giants, are ſtrewed with dead. This operation is no ſooner over, than the parent inſects ſtop up the hole at the entrance of the cell, to prevent the eſcape of ſuch of the wretched captives as may yet be alive. The young, when they leave their eggs, find themſelves amply ſupplied with proviſion. They devour, one after another, all the carcaſes with which they are provided; and when their laſt fly is eaten, they have no longer occaſion for food, but are changed into chryſalids, which afterward become ſavages of one ſpecies or another, according to that of the parent pair *.

Sphex ſemi aurata viridis †. The head, thorax, and abdomen of this beautiful ſpecies are of a finely gilded blue; the antennæ are yellowiſh; the eyes of a gilded brown, and legs of a dark blue.

The ſpirifex, or turner ſavage, is of a chefnut brown, with a ſhade of blue; the eyes are large and black; the antennæ brown; the body is ferruginous; the thorax and abdomen connected together by a yellow thread; the wings are of a duſky brown, and the ſting yellow ‡.

* Reaumur. Tom. VI. mem. 9. † Syſt. Nat. Ord. V. Gen. v. ſp. 33.
‡ Barbut's Gen. Inſect. p. 253.

## Genus VI.—*Chryſis. The Golden Fly.*

This tribe, like ſome of the preceding, has no probeſcis, but a mouth furniſhed with jaws: The antennæ are filiform and bended, conſiſting of ſeveral articulations, of which the firſt is the longeſt; the abdomen is arched underneath with a ſcale on each ſide; the anus is dentated, and armed with a projecting ſting; the body is covered above by the wings, through which it ſhines as if gilded *.

Among this family the ignita, or flaming chryſis, ſtands diſtinguiſhed by its reſplendent colours. The fore part of the head is green and gold, and the hind part of a beautiful azure; the thorax is likewiſe azure, with a mixture of green: The abdomen is green and yellow before, and behind of a copper red, reſembling that metal when highly poliſhed †.

* Syſt. Nat. Ord. V. Gen. 6. † Barbut, p. 256.

## Genus VII.—*Veſpa. The Waſp.*

There are no leſs than twenty-eight ſpecies of the waſp; many of which are univerſally known. The common characters by which the tribe is diſtinguiſhed, are, the jaws with which the mouth is armed; the four wings, the firſt pair of which are folded, and the ſharp pointed ſting which is uſually concealed within the body; the abdomen is joined to the thorax by a ſhort ſtalk, and the whole body is ſmooth *.

The crabro or hornet is not found in *Scotland*, though common in *South Britain*. The antennæ, head, and legs, are of a brown or cheſnut colour: the abdomen is of a fine orange brown; but on the extenſion of the annuli, it diſcovers on each ſide a line of black: the wings are of the colour of amber; and the animal, for ſize, merits the firſt rank among the veſpæ. It builds its neſt in the body of decayed trees †.

Veſpa vulgaris, the common waſp. The thorax of this ſpecies is black, ſurrounded on the anterior part by a yellow line; the abdomen is of a golden yellow, having triangular ſpots down the back part, and black ones on each ſide.

The waſps in general ſeem to fill up a middle rank between the ichneumons and the bees; like the former, they

* Syſt. Nat. p. 984. † Harris's Expoſit. Tab. 37, p. 327.

they are rapacious and carnivorous, and, like the latter, they conſtruct hives, and ſometimes feed on the produce of flowers; they devour fruit, butcher meat, and carry on continual hoſtilities againſt almoſt every other ſpecies of fly: they are at once the rivals and the enemies of the common bee; many of which annually periſh by their attacks.

Almoſt every perſon muſt have ſeen the eſtabliſhment made under ground by the common waſp. It is a kind of ſubterraneous city, which at certain ſeaſons of the year contains many thouſands of inhabitants, and is conſtructed nearly with the ſame ingenuity and elegance as that of the domeſtic bee. Like it, it is internally formed with combs, conſiſting of a number of hexagonal cells, all enveloped under one common covering, like coarſe paper, which is conſtructed with great art. In this particular they excel the common bee, which contents itſelf with the cover afforded by the hive, or with the trunk of a rotten tree, in their wild ſtate.

Though the waſps generally make choice of ſome large hole under ground for the conſtruction of their neſt, they have nevertheleſs much labour to undergo in removing protuberances, and carrying away earth, till it is brought to that ſpherical figure which ſuits their purpoſes. This work completed, they next conſtruct that paper like covering with which the whole hive is lined. The combs in which the cells are lodged next claim their attention: Theſe are ranged horizontally in different ſtories, ſometimes twelve or fifteen above each other, all ſupported by colonades, between which the whole citizens of this ſubterraneous commonwealth are ſeen at times to walk, like men in the ſtreets of a town. The cells of the waſps are

not conſtructed with that geometrical ſkill which has been ſo often admired in thoſe of the bee; but they are not on that account the leſs adapted to the purpoſes they are deſtined to ſerve. Each comb has only a ſingle range of cells, with their mouths opening below. They are intended, not for the reception of honey, but for the habitation of the young, which are fed twice or thrice a-day, by the morſels carried in by their parents. For the more commodious reception of their food, each of the larvæ has its head turned downward oppoſite to the mouth of its cell, ready to receive its meal when offered *.

There are, however, many varieties in the conſtruction of waſp hives, all ſuited to the views of the different ſpecies who inhabit them. Some have only a ſingle row of cells, placed vertically, like thoſe of the bee, and the mouths facing the ſun: The reaſon of this variety ſeems to be, that ſome kinds require the heat of the ſun to hatch their eggs; an advantage which could not be obtained, were there more rows of cells, or were they placed in a different manner.

As in a hive of bees, ſo in that of waſps, there are three different kinds of animals: At certain ſeaſons, it contains only a ſingle female, and a number of neuters or mules, who are of no ſex; at other times it contains ſome hundreds of females, and ſtill a greater number of males. The former are of a ſize ſo ſuperior to the mules, that one weighs againſt eight; even the male waſp is not more than half the weight of his female.

The condition of the female waſp differs widely from that of the female bee: The latter, when ſhe leads from



* Reaumur, Tom. VI. Mem. vi.

the parent hive a young colony, and founds a new empire, is eſſentially a queen; for ſhe is more implicitly obeyed than the beſt of monarchs, by the moſt loyal of his lieges. The female waſp, as her ſtation is more laborious, ſo her genius ſeems more enterpriſing. Unaided by any of her kind, ſhe lays, in the beginning of every ſeaſon, the foundation of a new edifice, which is deſtined to be the birth place of many thouſands of her ſpecies. She conſtructs the firſt cells, to which ſhe commits the earlieſt of her eggs, which in time become mule waſps, the moſt active and laborious of the whole race; and by theſe ſhe is aſſiſted in completing the reſt of the work.

The male waſps are not ſo ſlothful as the male bee; they diſcharge ſeveral duties in the interior parts of the hive; but in the art of building, either the cells or the external covering, they are altogether unſkilled. This falls to be executed by the mules, who carry it on with amazing diſpatch They collect together the ſmall fibres of half rotten wood, which they moiſten with a glutinous ſubſtance, and bake up into that paper of which all their work is formed.

The aerial waſp conſtructs ſmall neſts of about the ſize of an orange, which it attaches to the branch of a tree. This compact little edifice is expoſed to the weather, but is rendered impenetrable to rain, by a number of leaves which are placed round it, exactly reſembling an inverted roſe. A particular ſpecies in the neighbourhood of *Cayenne*, conſtruct a large oblong box, about twelve or fifteen inches long, of fine parchment, which is alſo pendent from the branch of a tree; there the combs fabricated of the ſame ſubſtance, are ranged horizontally, in different ſtories, one above the other; each having a round

round hole in the centre, by which the wasps are enabled to ascend or descend to different flats of their building *.

In the mean time, while these operations are carrying on by the joint labours of the hive, the mother wasp continues to lay till she has produced fifteen or sixteen thousand neuters or mules, and about five or six hundred males and females: The commonwealth day by day increases in numbers, and enjoys peace. Towards the month of *October*, provisions begin to grow scarce, and a new scene ensues: This hitherto amicable tribe seems then fired with mutual rage; and the whole edifice presents one scene of massacre. The neuters and males tear from their cradles the eggs, the larvæ, and new born insects, with undistinguishing fury. They next fight one against another. Hopes of the state, solicitude for posterity, or love to their native place, now no longer exist; the whole commonwealth is shaken to the foundation. Rains and frosts ensue; the citizens are seized with disease and languor; and happily for the other insects, and the fruit gardens, almost the whole die. Some few females escape from the disasters of civil war, and the severity of winter, and again in the ensuing spring become the founders of new empires, which are again to be overturned †.

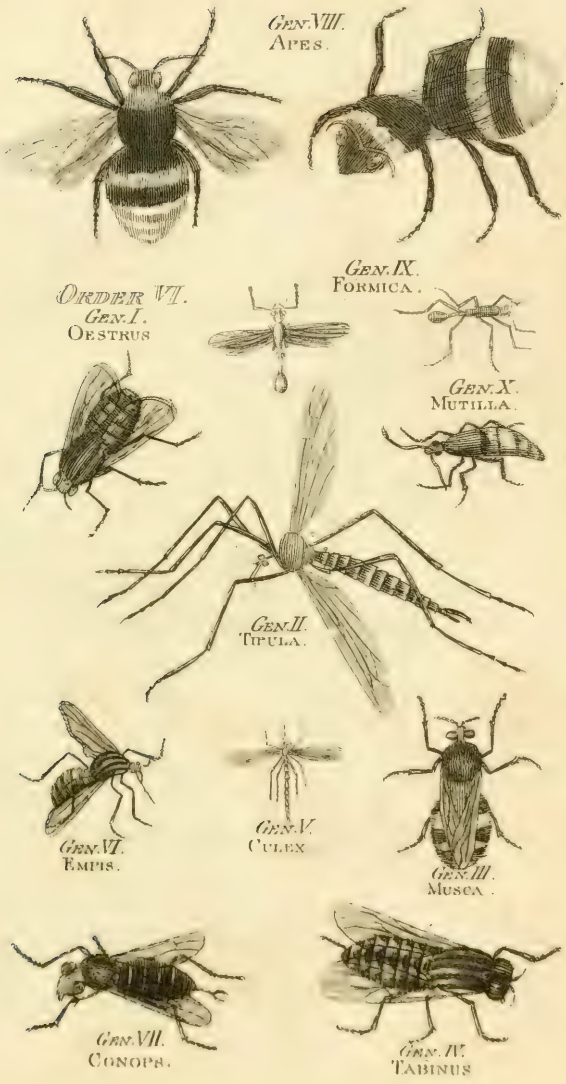
* Reaumur, ubi supra. † Barbut's Gen. Insect. p. 262.

## Genus VIII.—*Apis. The Bee.*

We are now come to a tribe of the moſt uſeful of inſects, whoſe hiſtory has been the ſubject of many volumes. Almoſt every writer on entymology has made the manners and economy of theſe animals a conſiderable part of his work; and many authors have treated of them, who have entered into no other department of natural hiſtory *. Several of theſe, catching that enthuſiaſm which is natural in contemplating creatures whoſe inſtincts are truly wonderful, ſeem to ſet no bounds to the eulogies they have laviſhed upon them. If you believe them, there is hardly any ſort of intelligence or moral virtue, which bees do not poſſeſs; and the whole of their manners are ſuch as afford us but too juſt cauſes of bluſhing at our own. The celebrated *Reaumur*, in detailing the economy of theſe animals, an object to which he applied himſelf with a perſeverance ſuperior to all mankind, has abſtracted much of the marvellous from their hiſtory; but in return, he has enlarged it with many facts and obſervations formerly unknown, and which ſucceeding experiments have ſeldom contradicted: The following brief account of theſe inſects, in general, reſts upon his authority.

There

* Among the moſt judicious naturaliſts who have written upon this ſubject, we may rank the following, viz. Mouffet, Merian, Aldrovandus, Johnſton, Charleton, Ray, Dale, and Reaumur.


Gen. VIII.
Apes.
Gen. IX.
Formica.
Order VI.
Gen. I.
Oestrus
Gen. X.
Mutilla.
Gen. II.
Tipula.
Gen. VI.
Empis.
Gen. V.
Culex
Gen. III.
Musca.
Gen. VII.
Conops.
Gen. IV.
Tabinus

There are, at certain ſeaſons of the year, three kinds of bees in every hive; the males, the females, and the bees without ſex. The latter every perſon is acquainted with; their number is beyond compariſon greater than that of the other two kinds. Nature ſeems to have deſtined them ſolely for the purpoſe of labour; and the whole drudgery of the hive lies upon them; hence they have properly been termed Working Bees.

It is only during one or two months of the ſummer, when the hive is moſt crouded, that males are found in it; and even then, they do not amount to a tenth part of the whole: They are of ſuperior ſize, and diſtinguiſhable by the characters afterwards to be noticed. During the whole courſe of the ſeaſon, except a few days, there is only a ſingle female to be diſcovered in the moſt numerous hive. Her fecundity, however, is ſo prodigious, that ſhe is ſoon capable of multiplying her family to ſuch a degree, that the hive can no longer contain it. To her the whole ſwarm, amounting from twenty to forty thouſand, owe their birth. Her reſidence is generally in the interior apartments of the lodging; when ſhe ſhews herſelf, ſhe is readily known from her ſize, being longer than even the male bees, but inferior in thickneſs. It is this female whom the ancients dignified with the title of King of the bees, and whom, with the utmoſt propriety, they might have denominated their Queen. From a number of well atteſted experiments and obſervations, it appears that the common bees pay her more than reſpect. They continually endeavour to be uſeful to her; and by careſſing her, and offering her honey, they ſeem to anticipate her wants. Her life is more precious than any

of

of the reſt; wherever ſhe goes, therefore, ſhe is encircled by a guard, that continually pays court to her *.

It is not without cauſe that this ſedulous attention is paid to the mother bee; ſhe is the ſoul of all their operations. If a hive is deprived of her, however numerous, it will undertake no labour; and the individuals will hardly give themſelves the trouble of collecting their daily ſubſiſtence. A ſwarm that was buſy from morning to night conſtructing cells and collecting wax, immediately upon this accident ſeems to forget that the flowers contain their food; they ſcarcely ſtir from the hive, conſtruct no new cells, nor even finiſh ſuch as were begun. The moment ſhe is reſtored, their wonted ſpirit and activity is reſumed by the whole ſwarm: Not only do the working bees reſume their labours when the queen is reſtored, but they ply them with an aſſiduity proportioned to her fertility. Although they contribute nothing themſelves to the generation of the young bees, the Author of Nature ſeems to have given them the ſame affection, and to have intereſted them in their welfare, as much as if they had been their real parents.

The external parts of bees are happily accommodated by their ſtructure, to the delicate operations they are deſtined to perform. Each of them is furniſhed with a trunk or proboſcis †, commonly folded up, but capable of being extended at pleaſure: It is with this inſtrument that they collect their food; not by pumping or ſucking, but by licking it from the nectaria of flowers; veſſels that have been but lately diſcovered by the botaniſts, but with

* Reaumur, Tome V. Mem. v.

† This ſmall inſtrument is ſaid to conſiſt of no leſs than twenty different parts, perceivable by the microſcope. Reaumur

with which the bees have been well acquainted from time immemorial *.

The teeth with which theſe inſects are provided, ſerve another purpoſe equally important; they are the inſtruments by which they faſhion and give a proper conſiſtency to the wax. That valuable commodity is not found in a perfect ſtate upon the flowers, as many have imagined; it is there ſcattered upon the ſurface in the form of a fine powder or duſt, and ſwept off by the hairy legs of the bee, and depoſited in a hollow part of each thigh, prepared for its reception. After being carried in that form into the hive, it is all ate up by the bee; and by the action of the ſtomach is brought into the ſtate of genuine wax. From the ſtomach, the working bee brings it back in ſmall parcels to the mouth, like a ruminating animal; and, by chewing it there, faſhions it into pieces proper for the conſtruction of the cell, to which it is applied, and afterwards poliſhed as the ſituation requires.

That ſmall ſcaly ſpine, commonly termed the ſting of the bee, is only the caſe of two needles or darts, extremely fine, and each dentated towards the point. The wounds made by theſe ſlender arms would be little to be apprehended, were their points not impoiſoned by a ſmall drop of acrid liquor. This liquor, which, when taſted, burns the tongue, is conveyed along a ſmall canal to the caſe of the ſting, on the tip of which it appears in ſmall drops, when the bee intends to make uſe of her offenſive weapons. However diſagreeable this inſtrument may ſometimes prove to us, it is abſolutely neceſſary to the bee, ſurrounded as that animal continually is with many enemies,

* The diligence of the bee is often alluded to in ancient poetry.
Apis mantinæ more modoq. grata carpentis thyma. Hor.

enemies, whoſe hoſtilities are conſtantly provoked by the honey and wax.

The ſting of the bee is alſo uſed for another purpoſe, the propriety of which we are not ſo well able to vindicate. At a certain time, they are buſy from morning to night in no other employment than maſſacring their aſſociates. The males, it ſeems, after the female is fecundated, become uſeleſs, and even offenſive to the reſt of the hive. The working bees, who had formerly been their nurſes, and hitherto had lived with them in the beſt underſtanding, all at once break looſe upon them with unrelenting fury, and in two or three days deſtroy the whole in one general carnage †.

Of the reaſons alleged by the working bees for this maſſacre, we are altogether ignorant; we know not upon what claim their power of life and death over the males is founded, farther than that nature ſeems to have granted ſuch a right, by giving them power to exerciſe it. Theſe, however, are not the only combats in which the bees are engaged: The working bees of the ſame hive often quarrel, and challenge each other to battle. Long do they ſtruggle in defence and attack, like two ſkilful pugiliſts, the one endeavouring to find a place in the ſcaly body of his adverſary into which he may thruſt his ſting, and the other as ſtudiouſly warding off the blow. The firſt wound that [illegible] puts an end to the engagement; and the victorious bee walks off, leaving his adverſary to expire in the duſt. Sometimes three or four attack a ſingle bee, without any deſign upon his life, but with a view to force him to diſgorge his honey; and as

† Virgil was acquainted with this peculiarity. Fucos a præſæpibus arcent ignavum pecus. Æn. Lib. ii.

as ſoon as they have ſucceeded, they lick it up, allowing the former proprietor to walk away.

Battles far more fatal and general are occaſioned when a neighbouring ſwarm, from poverty, or a principle of injuſtice, invade a hive already occupied. Scarcely have they entered the walls of the city, when a bloody engagement enſues: Thoſe who have the right of poſſeſſion oppoſe their invaders with all their forces, and with undaunted courage; not a minute paſſes that you do not obſerve a victorious bee dragging to the door of the hive a dead adverſary, or one who is yet ſtruggling in all the agonies of death. Theſe engagements do not cloſe but with the day; and before victory declares for either party, they often coſt thouſands their lives; for very often the one who has ſtung its opponent leaves its weapon in the wound, an accident which proves fatal to itſelf.

Inſects of their own ſpecies are far from being the only enemies which the bees have to fear; worms, waſps, hornets, and inſects of different kinds, never fail to make their way into the hive, wherever any rent or crevice is left open. When attacked by theſe robbers, they periſh in the unequal combat; and when dead, their bodies are ripped up, in order to extract from them the honey they contain. Appriſed of the fatal conſequences of admitting them into the hive, the bees carefully fill up every chink and crevice, not with wax, but with the glutinous matter that exſudes from certain trees, a ſubſtance ſtill more tenaceous. When a bee enters the hive loaded with a quantity of this ſtuff, it is met by others, who take ſmall particles of it, and apply it to the ſides of the part to be ſtopped up, till they are entirely cloſed.

A ſwarm of bees, however numerous, as we have already ſeen, all owe their birth to a ſingle female. This

queen, which *Virgil*, and the other writers of antiquity, have charged with all the cares of government, is indeed buſily occupied, but in functions of a different kind; and theſe are, the production of a vaſt number of eggs, which ſhe continues to drop, one after another, into the empty cells, during a conſiderable part of the ſummer. This animal, which is ſo amazingly productive, on being opened, has been found to contain upwards of five thouſand eggs, all of a ſize ſufficient to be perceptible. If we make allowance for thoſe that were already dropped, and many more not yet formed ſo as to become perceptible, we ſhall no longer deem it incredible, that this animal ſhould in one ſeaſon become the mother of ſo many thouſands. The moſt numerous hive is far inferior to the number of ſpawn that have been taken from the belly of a ſmall fiſh. During the whole time that the female goes from cell to cell depoſiting her eggs, ſhe is accompanied by the working bees, who tend her with the moſt officious care. And as the males and females are produced by her of a ſuperior ſize to the reſt, the working bees, as if appriſed of the circumſtance, conſtruct a few cells larger than the reſt; and what is ſtill more remarkable, the female herſelf knows which of the embryos are to become of her own ſex, and accordingly depoſits them in cells of a ſuitable capacity. The cell which is to contain the future queen bee is of a ſtructure different from all the reſt; and in building it, the labourers abandon the hexagonal ſhape which is beſt adapted to the ſaving of labour, and of wax; nothing, in this inſtance, ſeems to coſt them too dear: The cradle of their future queen conſumes as much as a hundred or a hundred and fifty of the ordinary cells.

From the great number of males in each hive to a ſingle female, the ancients were induced to believe, that fecundation among theſe inſects was not accompliſhed by any act of copulation, but that it was performed by a vivifying liquor ſhed upon the ova in the cells : But this opinion was overthrown, as ſoon as it was obſerved, that for nine or ten months in the year there was no male in the hive. *Swammerdam*, who could not obſerve that in theſe animals there were any parts of generation †, therefore ſuppoſed, that the female was impregnated ſolely by the effluvia of the male bees. The obſervations made by *Reaumur* have removed thoſe difficulties with which this part of the hiſtory of bees ſeemed to be attended. The female, who is ſurrounded by ſo many males, inſtead of being fatigued and perſecuted by their importunities, is obliged to careſs and inflame the paſſions of theſe drones, who are the moſt cold and indifferent of all their ſex. She mounts upon their backs, and puſhes her gallantry to what may be deemed indecency ; at length her allurements produce the deſired effect, and copulation is performed.

The female thus impregnated proceeds to lay her eggs, which are round and oblong, rather thicker at the one end than the other. Each is depoſited in a ſeparate cell, except upon ſome occaſions, when the induſtry of the working bees has not been ſufficient for the fertility of the mother : She then lays two or three in a ſingle cell ; the ſupernumeraries being afterwards carried away and placed by themſelves, as ſoon as new cells are provided. The ſingle egg which remains is faſtened to the bottom of the cell by the ſmall end, the only part which ſeems



† Biblia Naturæ.

to touch it. In a ſingle day or two after being placed there, it produces a worm, which the working bees take care to ſupply with ſuitable food, conſiſting of a whitiſh liquor, which ſerves it at once for ſubſiſtence and a bed; for it lies upon it, folded up like a ring. In the ſpace of ſix or ſeven days more, the whole of its growth is completed; and the bees, who know the time at which it no longer needs to be ſupplied with food, ceaſe to carry it any more. The laſt office which they render it, is cloſing up the mouth of the cell, which is done with wax.

In the mean time, the young animal within, which hitherto was almoſt entirely inactive, begins to ſpin ſilk, and line the inſide of its habitation, as a preparative to its entering into the chryſalis ſtate, in which it for a while remains. Thus, in the ſpace of about three weeks after it was firſt dropped into the cell, the young bee is ready to make its appearance as a winged animal. The firſt employment, after it has arrived at that period, is to gnaw off the wax with which the mouth of its cell had been ſtopped up. On its firſt iſſuing from the cell, the whole body is wet with the humid ſubſtance of the cell; but the affectionate bees flock around, and with their trunks aſſiſt it in wiping off the moiſture. The wings grow dry, and the limbs firm; and in the courſe of the ſame day, it iſſues forth with the labourers to collect wax and honey, and thereby to make returns to the ſociety for the care with which it has been reared.

Thus, after the commencement of ſummer, the number of bees daily continues to increaſe, till, by the month of *June*, they have become ſo numerous, that the ſame hive can no longer contain them. The only meaſure which then

then remains to be adopted, is, to divide; and in an inſtant, a large colony prepares to abandon for ever the place of their nativity, and to follow a young queen in forming a new eſtabliſhment for themſelves.

It is not merely the number of bees in a hive that determines them to ſwarm; that event depends on the young female, who muſt not only be ſufficiently ſtrong to lead the colony, but muſt alſo be impregnated; for upon that circumſtance depends the whole hopes of the future progeny: But no ſooner do all theſe predifpoſing circumſtances concur in a hive, than it prepares immediately for coloniſation. In the evening before that eventful period, indication of their intentions is given, by an unuſual noiſe and hurry within the hive. All the morning of next day paſſes without hardly a ſingle bee going to collect honey. Thoſe who are to leave the hive are preparing to take their departure; while thoſe that remain behind defer their operations, till their companions, by their leaving them, have afforded ſufficient room.

It is in the great enterpriſe of coloniſation that the influence of the queen bee is moſt clearly ſeen: Wherever ſhe alights, there the whole ſwarm take up their abode, and all cling around her body. If ſhe is removed, they all fly in queſt of her: if put into a hive where ſhe has not been placed, they either forſake it or die. Hence the art of thoſe perſons is explained, who go about ſhewing bees, making them alight on different parts of their body, and follow them for any length of time. They have poſſeſſion of the queen bee; and by that means can influence all their movements.

When a ſwarm thus migrates from the parent hive, it frequently happens that more than one female accompanies

nies it: The prosperity, however, of the new colony requires that there should be but one; one only is accordingly preserved. In a single day, all the rest are put to death; and it is found that the one which is spared is the best entitled to reign, because she is most fertile, or nearest her period of giving a new progeny to the society. The young females in the old hive, if any remain there, share not a more happy destiny; all the supernumeraries, like those in the swarm, are put to death.

We have already remarked that the bees have many enemies; and in some seasons, we are told, they are liable to fatal diseases: but of all their destroyers man is the greatest, from that barbarous avidity which gives rise to the practice of killing every hive that has collected a sufficient quantity of honey *. In the winter season, cold or hunger are the scourges which often destroy such as our rapacity has spared. In sheltering them from the one of these evils, we often expose them to the other. Too great a degree of cold makes them perish †: If placed in a situation too warm, they are awakened from their torpid state, and devour their food with an appetite which soon brings on a famine. Experience is the only guide that can prevent the bee master from falling into these extremes.

In *Egypt* and in *Greece*, where the collection of honey was deemed a trade of importance, the hives were regularly removed to a different part of the country, when the flowers had faded in another. It was for this purpose,

* Reaumur advises the French government to inflict an arbitrary punishment on all who *smoaked* bees. Tome V. p. 666.

† The ancients were of opinion, that bees benumbed with cold might be restored by hot ashes. Vid. Columela & Varo.

poſe, that boats ſtored with hives were ſet afloat on the *Nile*, gradually bringing the inſects within the reach of freſh food as the old was exhauſted. A ſimilar method was ſome time ago practiſed in *France* by a perſon who had ſix or ſeven hundred hives in his poſſeſſion †.

Such are the outlines of the hiſtory of the domeſtic bee, an inſect to which we are indebted for two material articles of our enjoyment, wax and honey. The genus of inſects to which it belongs is diſtinguiſhed into fifty-five different ſpecies, all differing in their manners, as well as their external form. Their common characters, in which they all agree, are, a mouth furniſhed with jaws and a probоſcis, inclining towards the body, and incloſed in a ſheath; wings which are extended, and without folds; three ſtemmata on the head, and ſtings carried in the other extremity by neuters.

Apis mellifica, the domeſtic neuter bee. This animal is ſo generally known, that no deſcription of its parts is neceſſary.

Apis mas, the *male* bee. This ſpecies has no ſting, nor are its feet or roſtrum fitted for the collection of wax or honey: it is larger than the common working bee: it hovers upon flowers; and its only office is impregnating the female.

Apis regina, the queen bee. This animal is eaſily diſtinguiſhed by her great length of body, and the ſhortneſs of her wings, which ſhe never uſes but when employed in leading out a young ſwarm.

Apis muſcorum, the humming bee ‡. The three former inſects, as they breed together, may all be deemed of the

† Reaumur, Tome V. Preſ. p. 40.

‡ Syſt. Nat. Ord. V. Gen. viii. ſp. 46.

the ſame ſpecies: this is larger in ſize, and more variegated in colour: It conſtructs its neſt in a haſty manner, of piles of moſs, collected in the meadows. The vaulted roof proves a ſecurity againſt rain, and the flooring of moſs below preſerves the neſt from damps.

The female bee collects unwrought wax, and a ſpecies of honey, in a few cells coarſely conſtructed, and there ſhe lays her eggs; the hive gradually increaſing, till it contain fifty or ſixty bees, which, by the froſts and rains of winter, are almoſt wholly deſtroyed. A few impregnated females ſurvive the ſeverity of the ſeaſon, and build new neſts in the ſpring, which are to be the cradles of new hives. Field mice, hornets, and ants, often plunder from theſe induſtrious animals the little veſſels of honey which they had laid up for the winter†.

† Barbut, p. 268.

## GENUS IX.—*Formica. The Ant.*

THE characters of this remarkable tribe are, a ſmall erect ſcale between the thorax and abdomen; truncated or broken antennæ, having their firſt articulation longer than the reſt; the females and neuters armed with a ſting, which is concealed in the abdomen. The males and females have wings, while the neuters are apterous *.

In the Syſtem of Nature, there are enumerated eighteen different ſpecies of the ant; of theſe, the largeſt is the hippomyrmex, or horſe ant, which is found in the hollow trunks of rotten trees. The head is black, and the thorax ferruginous; the feet are of the ſame colour, while the abdomen is brown: The erect ſcale between that part and the thorax, is oval, entire, pointed, and round †. The other animals of this genus moſt common, are,

The larger and ſmaller red ants. Theſe are found in woods, or under heaps of dry earth, and are the moſt laborious and induſtrious of the whole inſect tribe: under theſe characters they are frequently alluded to by almoſt every writer of antiquity.



* Syſtema Naturæ, Ord. V. Gen. IX.

† Vide Rai Inſ. p. 79.

The ants neſt is in fact a ſmall well regulated commonwealth, reſembling in many reſpects that of the bees. Like them, they are continually employed in labour, and have a large proportion of the citizens neuters, whoſe ſole employment, like that of the working bees, is collecting food for the ſociety. The males and females have wings, and ſeem deſtined for higher enjoyments, as well as more noble occupations. Their operations are all conducted in peace, union, and good underſtanding; though, if we are to credit the wiſe man as a naturaliſt, *they have no guide, overſeer, or ruler* *.

When they have choſen their ground for forming an eſtabliſhment, which is generally ſome dry and ſunny expoſure, all are employed in digging their retreat, to the depth of about a foot or more: They ſeem to take neither reſt nor food till it is completed; and to prevent diſorder or confuſion, their police aſſigns to every one his taſk. While one looſens the earth, another carries it away, and is met by others returning for a new load.

Within this hollow cave, when formed, theſe inſects all live in ſociety, and ſhelter themſelves from the ſeverity of winter. Even after the edifice is conſtructed, there is not a day allotted for reſt, ſo long as the weather will permit them to go abroad. They are continually wandering about in queſt of food, and carry all day each his burden into the neſt. Should one chance to meet with a booty which is too large for him to remove, he is ſoon perceived by the reſt, who come in legions to gnaw it into ſmaller pieces, or to aſſiſt in rolling along the unwieldy

* Vide Solomon, Prov. chap. vi. 9. Go to the ant thou ſluggard, conſider her ways, and be wiſe; which having no guide, overſeer, or ruler, provideth her meat in the ſummer, &c.

weildy maſs. Corn and ſeeds form an acceptable food; but as they are alſo carnivorous, they devour frogs and lizards when delivered over to them, or unable to defend themſelves.

Later naturaliſts have aſſerted, that all the food collected by the ants during the day, is depoſited in the common hall, and devoured every evening, or diſtributed to the young; and that, in winter, they paſs into a torpid and benumbed ſtate, in which they are incapable of taking any food *. This, however, is contradicted by the voice of all antiquity. *Horace* recommends its example to the miſer, as being noted for liberally enjoying during winter, whatever had been amaſſed by its own induſtry in the mild ſeaſon †.

We confeſs our incapacity to decide this matter; but having been unable, after all our reſearches, to find out the ant's winter ſtore, we are rather inclined to think that in that ſeaſon they either uſe none, or are ſatisfied with what they can occaſionally procure.

The eggs of theſe inſects are depoſited pretty early in the ſpring; and in order to provide the neceſſary warmth for their young, the old ants are ſeen carrying them out to expoſe them to the heat of the ſun. The worms go into chryſalids, and are metamorphoſed in their own ſkin. When about to iſſue forth into new life, it tears this white covering, and comes forth a perfect ant. The ants



* Barbut, and many other naturaliſts.

† ——————————— Sicut
Parvula, nam exemplo eſt, magni formica laboris
Ore trahit quodcunque poteſt, atque addit acervo
Haud ignara, ac non incauta futuri.
Quæ, ſimul inverſum contriſtat aquarius annum
Non uſquam prorepit, & illis utitur ante,
Quæſitis ſapiens. Lib. I. Sat. i. l. 33.

copulate in the air; and the females, who are the ſmalleſt of the race, ſeldom repair to the common habitation: What is their deſtiny, whether they die by the ſeverity of the winter, or fall a ſacrifice, like the bees, to the mercileſs fury of the labouring ants, is not aſcertained *.

We have already had occaſion to remark the fondneſs of theſe inſects for the ſaccharine liquor that exſudes from the plant louſe: it is in queſt of that food that they are frequently ſeen on plants, in the company of theſe inſects. In *Switzerland*, however, they are tranſported to trees for a different purpoſe; the deſtruction of caterpillars, and other vermin. A bag filled with ants is faſtened to a tree, with a ſmall hole purpoſely left open for them to creep out; they ſpread along the tree, and are prevented from leaving it, by a quantity of pitch with which the ſtem is covered. Rather than die by famine, they go in purſuit of the caterpillars among the leaves, and devour them.

* Barbut's Gen. Inſect. p. 280.

## Genus X.—*Mutilla.*

A few only of this tribe are winged; in thoſe that are provided with theſe inſtruments, they are reſplendent like pearl, and laid horizontally upon their backs. The antennæ are broken, and have the firſt articulation longer than the reſt; the body is covered with down; the thorax is obtuſe at the baſe; and the ſting is concealed within the abdomen *.

The common reſidence of the mutillæ is upon the ground, below moſs, eſpecially where there is a hollow ſpace between the moſs and the earth. They are gregarious, and when diſturbed in their retreats, they make their eſcape by running very ſwiftly. The mutillæ, for the greateſt part, are inhabitants of foreign climes: that moſt frequently ſeen in *Britain* is,

The mutilla *Europea*. The thorax of this inſect is a deep yellow, mingled with black velvety down; the prevailing colour of the abdomen is black, but is adorned with two, and ſometimes a greater number of yellowiſh white bands; the antennæ are black, and bending; the legs of the ſame colour, and hairy; the eyes are of a beautiful pearl white, ſhining from a head of a coal black.

* Syſt. Nat. p. 966.

## Order VI.—*Depterous Insects.*

This order comprehends all the numerous races of flies, tipulæ and gnats, which are characterised by having only two wings: Below each of these there is placed a halter or poiser, which is terminated by a knob, and has its base concealed under a little scale *.

* Syst. Nat. Ord. VI.

## Genus I.—*Oeſtrus. The Gad Fly.*

This inſect has no mouth, nor any viſible proboſcis: in place of theſe are three ſmall points. Upon the head, there are three ſtemmata, or ſmall eyes; the antennæ are ſetaceous, and commonly ſhort.

Oeſter bovinus, the ox gad fly. This large ſpecies penetrates through the ſkin of cattle, and depoſits its eggs there. It has no mouth, black eyes, a yellow thorax, and pale-coloured feet; the wings are membranous, and interſperſed with ſmall black ſpots *.

Oeſtrus rangiferus. This ſpecies frequents the backs of rein-deer, eſpecially thoſe that are tamed, and depoſits its eggs there; it is twice the ſize of the former, and called by the *Laplanders* curbma †. The wings are without ſpots, and the body is covered with a yellowiſh down.

Oeſtrus ovis, lodges in the noſes of ruminating animals, particularly of the ſheep, and is therefore called by the *Swedes*, nooſmalſken ‡. To this tribe is alſo added the œſtrus hæmorrhoidalis, which makes its way into the anus of the horſe, in order to depoſit its young §.

In the economy of nature, there is nothing appears more ſurpriſing than that inſtinct by which certain animals are directed to depoſit their young in the only place



* Rai Inſ. p. 271, & Derham's Phyſico Theol. l. 8. c. 6.
† Fauna Suec. N. 1025. ‡ Reaumur, Tome IV.
§ Voyage de Gotlande, 277.

where they can find ſuitable food, and neceſſary warmth. The young of certain flies are only capable of ſubſiſting below ground, and of deriving food from a certain flower, the narciſſus. The mothers of theſe depoſit their eggs in the roots of that plant. Other flies enter the anus of a horſe, becauſe their young are only capable of ſubſiſting in the entrails of that animal, where they remain till they are about to be metamorphoſed, and are then ejected with the dung *. Others are provided with a curious inſtrument, by which they perforate the hides of cattle; and in each hole thus made, they depoſit an egg.

Each of theſe worms, after being hatched, finds itſelf ſurrounded with its proper food, among which it grows; and the cell increaſes in ſize at the ſame time, till it ſometimes reaches the bulk of an egg. The wound becomes filled with purulent matter; and the opening from which it runs ſerves to ſupply the inſect with air. After the worm has grown there to its full ſize, it needs a place more dry, and of leſs heat, for its metamorphoſis; it then drops from the orifice of the wound, and betakes itſelf to ſome hole, or other retreat, where it is tranſformed.

An inſtinct as ſingular as any of the former is that by which ſome flies are directed to the noſe of a ſheep, a goat, or a deer, to lay its eggs. It is in the frontal ſinus of theſe large animals, that the worms produced by theſe eggs are deſtined to ſearch for the only food capable of ſupporting them. Some of theſe worms, after being ejected from this ſtrange nidus, become covered with a hard ſhell, in which their laſt change is completed. Nature, which provides for every exigence, has furniſhed this

* Reaumur, Tome IV. Mem. xii.

this ſhell, which is of a texture too hard for the animal to break, with a valve at one end, faſtened only by a ſmall thread. At the firſt effort for freedom which the young æſtrus makes, the door gives way, the priſon opens, and the inſect flies to thoſe woods and meadows that were frequented by its anceſtors *.

* Reaumur, ubi ſupra.

## Genus II.—*Tipula. The Crane Fly.*

In this tribe, the mouth is a prolongation of the head; the proboſcis is ſhort, and bent inwards; the upper jaw being arched: All the different ſpecies, which are no leſs than fifty-eight, have two palpi, which are incurvated, and longer than the head *. The whole genus is readily diſtinguiſhed by the enormous length of their legs, by which they are enabled to walk among the graſs, as men are aſſiſted by ſtilts in paſſing through marſhy ground.

The tipula maxima of *Ray* is one of the largeſt ſeen in this country: The wings are variegated with brown and white; the body and abdomen are of an aſh-coloured brown †.

Tipula crocata, the ſaffron crane fly. This elegant ſpecies has the thorax and ſcapuli of black hue; the belly ſaffron: the wings are marked each with a ſmooth reſplendent ſpot of a brown colour; the reſt of the wings are yellow, and the annuli of the abdomen are diſtinguiſhed by alternate bands of yellow and black ‡.

The aſh-coloured tipula is mentioned by *Goedart* §, *Lewenhoek* ¶, and *Reaumur* ||. The whole body is of an aſh-

* Syſt. Nat. p. 970. † Rai. Inſect. p. 72. No. 2.
‡ Actes d'Upſal, 1736, p. 30. § Part II. p. 165.
¶ Epiſt. 1693, Dec. 20. || Tome IV.

ash-colour; the wings of a water-colour, having a brown longitudinal bar upon their exterior parts. It is found among garden plants.

The larger tipulæ are known by the name of Sempstresses; the small by that of Culiciform. The latter, in fine summer evenings, flutter about the sides of rivers in legions. The shrill noise which they make with their wings is not very discernible unless they are very near. They are sometimes taken for gnats; but they want their proboscis, and their manners are far more inoffensive.

The tipulæ, before they become inhabitants of the air, creep in the form of grubs: Those of the larger kinds dwell in holes of decayed willows, where they change into chrysalids. In that state, they have the power of breathing through small curved holes. The larvæ and chrysalids of the smaller tipulæ are generally found in water; they are extremely various both in colour and form: Some have cylindrical tubes through which they breathe, even while considerably immersed in water, by stretching their points to the surface *. They swim with great nimbleness, but seldom forsake the hole they have dug in the bank of the river. There are others of these animals that spin a silken coat, that receives part of their long body before their transformation. After these operations are performed, all of them renounce their reptile and aquatic life, having received instruments of flight from the hands of nature. Their frame is then so weak, that a touch is enough to crush them. They are sometimes of a beautiful green, sometimes coal black; but the most remarkable are those whose fore legs, though extremely long, do not touch the ground, but move in the



* Reaumur, Tom. V. Mem. i.

air like antennæ. In this their laſt and moſt perfect ſtate, the tipulæ being provided with proper organs, apply themſelves to the important work of propagation; and having provided for another generation, their ſhort exiſtence draws to a cloſe *.

* Barbut, Gen. Inſ. p. 294.

## Genus III. *Muſca. The Fly.*

This numerous tribe is characteriſed by that ſoft and fleſhy proboſcis which forms the mouth, and by being deſtitute of palpi. There are about an hundred and thirty different ſpecies of flies already known to naturaliſts, who have divided them into two grand ſections; thoſe with filiated and ſimple antennæ, and thoſe whoſe antennæ are furniſhed with a lateral hair or feather *.

Nothing ſo clearly demonſtrates the imperfection of the ſcience of entymology as the ſmall number of flies that have been hitherto deſcribed by naturaliſts. The Syſtem of Nature in its laſt ſtate of enlargement, was ſuppoſed to contain the moſt accurate and complete enumeration of inſects that has yet been publiſhed: *Mr. Harris*, however, in his Expoſition of the *Engliſh* inſects, deſcribes a greater number of flies indigenous in this country, than the *Swediſh* naturaliſt had diſcovered on the whole face of the globe. *England* is at the ſame time far from being the moſt productive country of theſe animals. In *Spain*, they were formerly ſo numerous, that the fly-catcher, we are told, was not only a profeſſion, but a number of men were commiſſioned by government to give chace to theſe troubleſome invaders. In all hot climates they multiply to a degree almoſt intolerable, and

* Syſt. Nat. Ord. VI. Gen. iii.

and are extremely deſtructive to butcher meat, and other kinds of proviſion.

Next to the number of flies, their variety claims our attention. The different ſpecies are extremely diverſified in their external form, their ſtructure, their organization, their metamorphoſis, their manner of propagating their ſpecies, and in providing for their poſterity. A full explanation of theſe different parts of their economy, would require a large volume, and would conſtitute a narrative to many readers not uninteresting. Such an undertaking, however, is incompatible with the limits preſcribed to our work.

Some of theſe inſects have trunks inſtead of a mouth; others have that organ armed with teeth; and many have both a mouth and a trunk. The proboſcis of flies is a machine contrived for pumping the blood from the veſſels of large animals, and the nectar from the petula of flowers; and the ſcience of hydraulics has not enabled men to conſtruct machines more complicated, more exactly arranged, or better adapted to theſe purpoſes. Some of them poſſeſs conſiderable firmneſs and ſolidity, thoſe eſpecially that are deſtined to pierce the ſkins of cattle. In order to ſee them at work, all that is neceſſary is to expoſe a ſyrup to attract them, and to take up a lens for their inſpection.

Each eye of the fly contains in it an aſſemblage of a great number of ſmall ones, which probably have the effect of multiplying the ſurrounding objects, and creating repreſentations of them, which the experience of the inſect corrects *. From the eye, if you paſs along and ſur-

vey

* Reaumur, Tome IV. Mem. vi.

vey the body, you find it provided with the organs of reſpiration. Four ſmall ſtigmata, for this purpoſe, are found upon the thorax, and a greater number diſperſed over the annuli of the abdomen. The covering of the different parts of the abdomen are ſcaly, and do not conſiſt all of one piece, but admit of the contraction and dilatation of that part, according to the circumſtances of the animal. Each of the feet terminates in a ſmall bunch of *ſetæ*, reſembling a bruſh.

The interior organization of this genus, when examined with a proper apparatus, preſents two pulmonary ſacs of a white colour, arranged longitudinally along the body. As the bodies of ſome ſpecies are diaphanous, the action of the heart may alſo be diſcerned, as well as the liquor it contains, continually driven along the great artery leading to it, and returning by the ſame courſe*. During their larva ſtate, the flies in general go through a greater variety of metamorphoſes than even the ſilk or butterfly worms: During their progreſs from the vermicular to the chryſalis ſtate, they paſs through an intermediate change, unexperienced by other inſects. From the ſhortneſs of their lives, all theſe viciſſitudes muſt rapidly ſucceed each other: this circumſtance, however, does not prevent many ſpecies from conſtructing a coque for their laſt metamorphoſis, of a curious fabric. The greater part of theſe coques are of ſilk, with a mixture of other materials; thoſe, indeed, moſt common with us, ſerve themſelves with their own ſkin, which becomes an incruſtated covering to protect them during their dormant and aurelia ſtate.

When

* Idem, ubi ſupra.

When the different members have acquired ſufficient firmneſs, the fly is ready to burſt from its ſhell in its winged form. The covering of the chryſalis, eſpecially of thoſe who are metamorphoſed in their own ſkin, ſeem to prove, by their hardneſs, an effectual bar to that event. About the time, however, of its change, the head of the fly is capable of being ſwollen and dilated in an unuſual manner; and it is by means of this dilatation that the fly burſts its covering, and opens a paſſage for its eſcape.

The food of flies is as various as their different kinds; ſome being ſupported wholly by vegetable ſubſtances, while others are carnivorous; and among the latter there are ſome who only devour fleſh in a ſtate of putrefaction. Dung, and vegetables in a ſimilar ſtate, are the favourite meals of others. In the hiſtory of the æſtrus, we have already noticed that inſtinct by which the females are directed to depoſit their eggs within reach of food proper for each ſpecies †.

The female flies are all fecundated by copulation; an act in which the moſt incurious obſerver muſt have frequently ſeen them engaged. The obſervations of *Reaumur* ſeem to prove, that the females of ſome kinds take that part in the act of fecundation which is uſually performed by the male in other animals; and that it is her extremity which penetrates into the body of the male. The far greater part of inſects are oviparous; ſome, however, belonging to this genus bring forth living young: But what appears moſt unaccountable is, that ſome apparently of the ſame ſpecies are viviparous, while the reſt lay

† Page 97.

lay eggs; a circumſtance that ſhews the futility of our attempts to arrange them. Some of the viviparous flies poſſeſs a degree of fecundity that muſt appear altogether incredible to thoſe who have not been verſant in the ſtudy of inſects. Some of them have been found to contain in their body no leſs than twenty thouſand living animals at one time *.

*Muſca domeſtica*, the houſe fly. The thorax of this ſpecies is brown, having upon it four occult dark lines; the abdomen is of an orange brown, with a few ſpots of black. This fly ſeldom makes its appearance before the month of *July* †.

*Muſca veſpæ ſimilis*, the waſp fly, entirely reſembles the animal whoſe name it bears; the head is lemon coloured; the antennæ are brown; the thorax and abdomen are black, the latter marked with tranſverſe bands of yellow.

*Muſca pellucens*, the tranſparent fly. The thorax is black, partially covered with a few brown hairs, and having the point ſometimes yellow: The abdomen has its under part black, the upper white, and is tranſparent both above and below ‡.

* Reaumur, Tome IV. Mem. x. † Harris's Inſ. p. 144.
‡ Barbut's Gen. Inſ. p. 301.

## Genus IV.—*Tabanus. The Horſe Fly, or Flogg.*

The inſects of this genus are the great tormentors of horſes and black cattle; their proboſcis is ſhaped like a ſting; and with it this fly ſucks out the blood of larger animals, which is its favourite food. Notwithſtanding its diminutive ſize, and apparent inſignificancy, it engages with the bull, and at once enjoys the honours and the fruits of victory: For in ſpite of all his efforts, it glats itſelf with his blood. Cattle, either when intended for fattening or for milk, are greatly harraſſed and injured by theſe inſects in the hot months; and whoever would prevent their miſchief, would certainly be entitled to thoſe honours and rewards that are due to the diſcoverers of uſeful improvements in rural economy.

*Tabanus bovinus*, the ox fly. In this ſpecies the head is grey; but the eyes, which occupy the greater part of it, are brown. The thorax is of a grey colour, and the abdomen yellow.

*Tabanus niger*, the dark brown. This ſpecies varies conſiderably in colour; ſome deſcribe it as approaching to black; others grey *, and ſome dark brown. The wings are grey; the feet brown; and the ſegments of the abdomen are black, with a clay coloured edging upon each. This inſect is a great tormentor of the rein deer in *Lapland* †.

* Fauna Swecica, Ord. VI. Gen. vii. † Regne Animale, p. 198.

## Genus V.—*Culex. The Gnat.*

The inſects of this tribe are extremely numerous, and univerſally known, by the uneaſineſs they occaſion. The *Swediſh* naturaliſt only enumerates ſeven ſpecies; but there are ſome places in *America* where a number of non-deſcripts might certainly be found. The genus is diſcriminated by the mouth, which conſiſts of a flexible ſheath, incloſing briſtles pointed like ſtings. The antennæ of the males are filiform, thoſe of the females feathered *.

In their larva ſtate, theſe animals are aquatic: During the greater part of ſummer, all ſtagnated waters are full of their ſmall worms, hanging with their heads downwards, while their hinder parts reach the ſurface of the water. In this ſtate, the ſtigmata, or organs of reſpiration, are ſituated near the anus; and hence the reaſon why theſe parts are frequently ſeen within reach of the atmoſphere. It is in this ſtate, too, the gnat is provided with ſmall fins on its ſides, to enable it to go in queſt of food.

After having remained in the ſtate of larva for near twenty days, theſe inſects are transformed into chryſalids, in which all the limbs of the winged gnat are diſtinguiſhable through the diaphanous robe with which they are then ſhrouded. After remaining three or four days



* Syſt. Nat. p. 1002.

wrapped up in this ſpiral manner, they become gnats, and aſcend into a new element. No ſooner does the chryſalis reach the ſurface of the water, than the inſect with its head burſts the ſhell, which then ſerves it for a boat, of which the wings are the ſails. If in this critical moment a breeze ariſe, it proves to theſe pigmy ſailors a dreadful hurricane; for it overſets the little bark, and the inſect not being yet diſengaged from it, ſuffers a fatal ſhipwreck. If, however, the weather prove calm, the gnat makes a more proſperous voyage: Having time to dry his wings before leaving the boat, he is enabled to mount into the air; where, contemptible as he may ſeem, he ſoon becomes the inveterate tormentor of the lords of the creation *.

*Culex cinereus* †. This ſpecies is the moſt numerous and common; it is called by the *Swedes* Mygg ‡, a name it has alſo received in ſome parts of *Britain*. The body is of an oblong ſhape, and the colour is cinereous. It is this ſpecies which, towards evening, is ſo troubleſome to man and other animals. Its efforts are far more feeble and temporary than thoſe of the muſquito in *North America*, where the inhabitants are obliged to have their beds cloſe hung with a thin cloth, called Muſquito Curtains, to prevent their intruſion.

* Reaumur, Tome IV. † Fauna Swecica.

‡ Vide Flora Lapponica, p. 363, & Blankner, p. 171.

## GENUS VI.—*Empis*.

THE empis is diſtinguiſhed by that horny ſubſtance which forms the proboſcis; it is bivalved, inclining downwards under the breaſt, and is longer than the thorax; the valves are horizontal *. The antennæ of theſe inſects are compoſed of three articulations; the firſt is long, the ſecond ſhort and globular, and the third much larger at its baſe than in the middle; from whence it again grows larger, and is finally terminated by a long ſharp point †.

The empis, in its winged ſtate, is ſeen frequenting flowers; but its manners and reſidence in its larva and chryſalis ſtate are but imperfectly known to the naturaliſt.

*Empis livida*. This ſpecies is of a leaden colour; the thorax is gibbous, of a pale green, and marked longitudinally with three black lines: The upper part of the abdomen is duſky brown: and the legs, which are long and hairy, are of a deeper ſhade of the ſame colour.

* Lin. Syſt. Ord. VI. Gen. vi. † Barbut, p. 311.

## GENUS VII.—*Conops.*

THERE are thirteen different kinds of this tribe enumerated by naturaliſts, who have diſtinguiſhed them by a ſtriking character drawn from the roſtrum, which is porrected, and jointed like the knee. Theſe inſects are univerſally ſpread; and from their air and general appearance are commonly taken for certain kinds of waſps. They come later in the ſeaſon than the horſe flies, but are much greater tormentors of the horſes, were they equally numerous.

*Conops veſpa.* The antennæ of this inſect terminate in a broad articulation, like the mouth of a ſpoon; and which, when cloſely examined, appears very hairy. The feet and poiſers are dun coloured; the thorax is variegated with black and reddiſh caſts of the ſame colour, which alſo prevails in the abdomen. Theſe inſects are of a large ſize, and many of them adorned with very vivid and reſplendent colours †.

† Vide Barbut, p. 310, 311.

## GENUS VIII.—*Aſilis.*

THIS tribe is much more ſlender in the body than the preceding; many of them are ſuperior in length; and they all glow with the moſt brilliant tints of green, purple, yellow, and brown. The generic characters are, a horny roſtrum, porrected, ſtrait, and bivalved †.

Theſe animals are generally found in ſwampy meadow ground, where, like the preceding tribe, they prove very troubleſome to cattle. They are provided with a ſting, which inflicts a very painful wound, if you incautiouſly endeavour to lay hold of them. The proboſcis, though ſharp enough to perforate the thickeſt ſkin, is nevertheleſs perforated, and ſupplies the place of a pump, in ſucking out the blood of animals.

*Inuſca crabroniformis* ‡, the ferruginous aſilis. The thorax is gibbous; the abdomen oval, ſlender, and tapering §; the three firſt ſegments of the abdomen are black, the reſt yellow; the feet and wings are of an iron colour. The graziers imagine, and perhaps with juſtice, that of all the inſect tribe, this is the moſt noxious to black cattle; the very noiſe of their wings ſets them a-running; and before they ſtop, they generally make their eſcape into a river, if any is near ¶.

† Syſt. Nat. p. 1006.
§ Actes d'Upſal, 1736, p. 29.
‡ Vide Mouffet, p. 46.
¶ Hoffnagel, t. 16.

## Genus IX.—*Bombilius. The Buzz Fly.*

The *Britiſh* inſects of this genus, in the month of *April*, are ſeen hovering about the garden flowers, generally in damp ſituations. Even when in the act of ſipping the nectarous dew from plants, they do not ſettle, but keep conſtantly buzzing upon the wing. They have no ſting, and may be handled with impunity.

The characters of this genus are, a roſtrum very long, ſetaceous, and porrected, formed by two horizontal valves; antennæ which are bent, ſetaceous, and of a conic form; three ſtemmata, and two ſpread wings.

*Bombilius medius* †. The proboſcis of this inſect is black, and ſlender, ſometimes divided in two at the extremity, which extends nearly three fourths of the animal's length: the legs are of the ſame colour, ſlender, and long in proportion to the ſize of the inſect. The body is ſhort and truncated; the ground colour black, but covered externally with dun coloured tufty down; the wings are unuſually long, dark, and dotted with brown ‡.

† Syſt. Nat. No. 2. ‡ Barbut, p. 317.

## Genus X.—*Hippoboſca. The Horſe Leech.*

In the horſe leeches, the roſtrum is of a cylindrical ſhape, bivalved, and nodding: the feet are armed with claws; and it is by means of theſe inſtruments that they adhere to cattle and horſes, in ſpite of every effort to rub them off. They abound in *New Foreſt*, *Hampſhire*, and render it a very uneaſy paſture for cows. The horſe leech is covered with a cruſtaceous ſhell, which renders it difficult to be killed, and gives it the air of ſome ſpecies of the bugs.

*Hippoboſca pedibus pidactiliis*, the horſe leech with four talons on each foot. This ſpecies is but too generally known, from its hoſtilities againſt every kind of cattle. It is ſo tenacious of life, that it will live for a conſiderable while after the head is cut off. The colour of this hippoboſca is wholly grey *. There is a ſpecies of theſe animals with ſix talons on each foot, which is found in ſwallows neſts; it is much ſmaller in ſize, and has the extremity of the abdomen marginated †.

* Ricinus volans of M. Friſch, p. 43. † Reaumur, Tome V.

# CHAPTER VIII.

## Section I.

### Order VII.—*Apterous Insects.*

A multifarious group of animals are comprehended under this order, which are all characterised by the privation of wings in both sexes. All the varieties of crabs and lobsters are introduced by *Linnæus* into this class of the animal kingdom; and that with great propriety, because they possess the antennæ, those organs which are peculiarly characteristic of the insect tribes.

Plate XI.

*Gen. IX.*
Bombylius.

*Gen. VIII.*
Asilus.

*Gen. II.*
Podura.

*Gen. X.*
Hippobosca.

*Order VII.*

*Gen. I.*
Lepisma

*Gen. IV.*
Pedicules.

*Gen. VI.*
Acarus.

*Gen. III.*
Termes.

*Gen. V.*
Pulex.

## GENUS I.—*Lepiſma.*

THE inſects of this genus are diſtinguiſhed by poſſeſſing ſix feet formed for running; a mouth furniſhed with four palpi; two of which are ſetaceous, and two capitated. The body is covered with imbricated ſcales; and the tail is terminated by briſtly appendices †.

The reſidence of the lepiſma is commonly in gardens and damp houſes. In the former, they retreat under mouldy boards or flag-ſtones; and in the latter, they are ſeen about window ſaſhes, and old boxes that have remained for ſome time in a humid ſituation. When their haunts are diſturbed, they make off with ſo great velocity, that they are but ſeldom caught; and when that happens, they are often deſtroyed, being, from their ſoftneſs, eaſily cruſhed.

*Lepiſma ſaccharina* ‡. The colour of this inſect is a ſhade of lead, brightening into ſilver: Its moſt conſpicuous member is the tail, which conſiſts of three long threads, ſlender and fine; but if viewed with a microſcope, are covered with tufts of hair. The antennæ of this lepiſma are long and filiform; in ſome, they are nearly equal to the length of the body: The feet are ſix in number, preſenting a ſhort and truncated appearance at their inſertion: They are received into a groove in the body



† Syſt. Nat. Ord. VII. Gen. i. ‡ Syſt. Nat. ubi ſupra.

of the animal, where each has its origin, covered with an oval ſcale. Towards the tail there are ſix other appendices, much ſhorter, which may be termed falſe feet, as they ſeem to give no aſſiſtance to the progreſſive motion of the animal *. There are only three ſpecies of this genus enumerated in the Syſtem of Nature.

* Barbut's Gen. Inſect. p. 322.

## GENUS II.—*Podura. The Springtail.*

THERE are above a dozen of different kinds of the ſpringtail; they derive their *Engliſh* name from their habit of bounding from the ground; an exertion which is performed by means of the forked elaſtic tail which bends under the body, and acts like a ſpring. The antennæ of the ſpringtails are long and ſetaceous; their ſix feet are formed for running; and their eyes are compoſed each of eight facets †.

*Podura villoſa*, the rough ſpringtail, is a *Britiſh* inſect, and the largeſt of the tribe known to us. The ground-colour is dark brown, mixed with a ſhade of yellow, and variegated all over with ſtreaks of black. The abdomen of this inſect alone is ſmooth, the head being very much covered with hairs, which are ſo deciduous, that they ſtick to the fingers on handling the animal; the antennæ, in the ſubject we ſaw, conſiſted of four articulations, and were nearly as long as the body.

This lepiſma is generally found below ſtones; but there are others of the genus that ſeem purely aquatic, and able to walk and ſkip upon the ſurface with apparent eaſe. It is this ſpecies that we may obſerve in the mornings aſſembling in pretty numerous tribes upon the banks of ſtagnated pools. Other ſpecies reſide among rotten bark, or decayed leaves; and in *Sweden* there is a ſpecies which runs

† Vide Syſt. Nat. p. 1013.

runs upon the ſnow, but periſhes there as ſoon as it begins to thaw †.

*Podura atra terreſtris alba* ‡. This ſpecies frequents melon beds and hot-houſes; where, on watering the ground, numbers are ſeen jumping into the air like atoms: They are the ſmalleſt of the poduræ, and of a white colour.

† De Geer, Actes d'Upſal, 1740, p. 54. ‡ Fauna Swec. Gen. iv.

## GENUS III.—*Termes.*

THE diſcriminating characters of theſe inſects are drawn from the mouth, which is armed with two jaws; from the ſetaceous antennæ, and the ſix feet, which are formed for walking †.

There are only three ſpecies of theſe ſmall inſects; to one of which *Linnæus* has given the name of Pulſatoria, from its being ſuppoſed to imitate the *ticking* of a watch, by ſtriking its head againſt the wainſcot in the dead of night. This noiſe, ſo alarming to ſome ſuperſtitious minds, has been called the *death watch*, and is probably occaſioned by the plinus one of the coleopterous inſects.

The termes pulſatorius varies in its colour according to its reſidence: When met with in houſes, it is commonly of a whitiſh colour; if found in the fields, as is ſometimes the caſe, it tends more to a brown colour, and is ſomewhat hairy ‡.

† Syſt. Nat. p. 1015. ‡ Barbut's Gen. Inſect. p. 326.

## GENUS IV.—*Pediculus. The Louse.*

THE characters of this unſeemly tribe are, ſix feet formed for walking; a mouth containing an exſerted ſting; antennæ as long as the thorax; and an abdomen depreſſed, and formed of different lobes or ſegments †.

It is remarkable that almoſt every animal and vegetable is frequented by its particular louſe, although only about fifty different ſpecies of this tribe have yet found their way into the ſyſtems of natural hiſtory. Even man, whoſe fancied prerogatives lead him to boaſt of being the lord of the creation, has often the mortification of being trampled upon by the moſt deſpicable of all animals.

*Pediculus humanus*, the human louſe. Of this inſect there are two varieties; the one inhabits the head, and the other the body. No medical inquiries have yet found out why ſome families of the ſame tribe chooſe theſe different abodes. Infants and children are moſt infeſted with the former of theſe kinds, and ſailors, ſoldiers, and old men are moſt liable to be troubled with the latter. Cleanlineſs is the beſt antidote againſt theſe hideous intruders; and their naufeous ſociety ſeems a very proper puniſhment inflicted by nature on its neglect. The phthiriaſis, or louſy diſeaſe, though very little known in latter times, was not unfrequent among the ancients. *Herod*, *Antiochus*, *Calliſthenes*, and *Sylla*, with many others, died of

† Syſt. Nat. p. 116.

of this diſorder. It is uncertain whether this is to be aſcribed to their inattention to cleanlineſs, their ſcarcity of linen, or their ignorance of the uſe of mercury. However this may be, there is no perſon in our climate attacked by theſe animals, except ſuch as by ſloth and naſtineſs invite their company.

We will ſpare our readers the trouble of peruſing a more minute deſcription of this motly tribe: Such, however, as are not ſatisfied with their *perſonal* knowledge, we refer for farther particulars to *Rhedi* *, *Swammerdam* †, and *Bonani* ‡, where they may enjoy an intellectual feaſt, of which few will envy them.

* Exper. t. 18. † Quart. 169. ‡ Micogr. f. 55.

## Genus V.—*Pulex. The Flea.*

This genus conſiſts of two ſpecies, which are characteriſed by ſix feet formed for leaping; filiform antennæ; a roſtrum bent inwards, ſetaceous, and concealing a ſting: The abdomen is laterally compreſſed, and covered with imbricated laminæ *.

This tribe, like the preceding, is blood-thirſty, and fattens at the expence of the human race. It is ſaid to prefer the more delicate ſkin of women; but feeds neither upon epileptic perſons, upon the dead, nor the dying. Other animals, as well as man, ſuffer by its intruſions. It neſtles in the fur of dogs, cats, and rats; and the neſts of the river ſwallow ſwarm with them †.

*Pulex irritans*, the bed flea. In this animal, the antennæ are longer than the thorax; the body of a dark brown colour, and of an oval form; it is apterous, walks but little; but by the elaſticity of its legs, can ſpring above two hundred times the length of its own body. From microſcopic obſervations which have been made upon this animal, it has been found to be oviparous ‡. The eggs are depoſited on blankets, or among the down of animals; they are round and ſmooth; and in four or five days, give birth to a very minute worm, which feeds upon greaſy fur. After having crept about in this larva ſtate

* Syſt. Nat. p. 1021. † Syſt. Nat. du Regne Animale, p. 231.
‡ Bonafi Microgr. f. 56.

ſtate for a few days, it ſpins a ſilken cod, in which it lies dormant for about a fortnight; after which it burſts from its confinement, endowed with powers to diſturb the peace of an emperor.

Preparations of mercury are effectual in deſtroying the flea, and moſt other noxious vermin. In ſome places, bugs, fleas, and other abominable inſects, are held in ſuperſtitious veneration. At *Surat*, there is an hoſpital endowed for their preſervation; where every night they prevail upon ſome poor wretch to ſuffer himſelf to be preyed upon for their ſuſtenance. They faſten him naked upon a bed, where he is deprived of the means of ſelf defence; and the famiſhed penſioners riot in his blood during the whole night *. Another pious foundation of a ſimilar nature, but leſs ludicrous, is erected in *Turkey*, for decayed or infirm dogs.

* Barbut's Genera, p. 332.

## Genus VI.—*Acarus. The Tick.*

The ticks have all eight feet; two eyes, placed one on each ſide of the head, and two articulated tentacula, in the form of feet *. The tribe contains thirty five different ſpecies, many of which have been inaccurately placed in the genus of lice.

The ticks are all produced from eggs; the females being oviparous. Many of the ſpecies of this genus are carnivorous, and prey upon man, as well as other living creatures. When, however, this food is not to be procured, they are capable of deriving their ſubſiſtence from plants and vegetables. The dyſentry and the itch, two inſupportable diſeaſes, are both occaſioned by ſome of the ſmaller acari inſinuating themſelves into the human body. In the latter of theſe complaints, they dig under the ſkin, and occaſion that raging pruriency with which the unhappy patient is afflicted †.

*Acarus longicornis* is found below ſtones and the bark of trees. The abdomen and legs are of a red colour; and the whole inſect ſomewhat reſembles the ſhape of a pear The antennæ reſemble thoſe of the ſcorpion, the articulations being proportionably ſmaller and more ſlender; their extremities terminate in a forceps formed by two threads ‡.

Some

* Syſt. Nat. p. 1022. † Acarus Scabici, Actes d'Upſal, 1736. p. 3[illegible].
‡ Friſch, 8. p. 2. t. 1.

Some of the acari are well known to frequent cheese; others of them attach themselves to the legs and bodies of bees, spiders, and other insects. The pediculus pubis of *Rhedi*, the cow and sheep louse, seem all to belong to this tribe: The former is engendered, or at least multiplied, by uncleanliness upon the pudenda, where it is more vexatious than the louse *.

The monoculus, or arborescent water flea, may also be added to the tribe of acari †. This insect, when viewed with the assistance of the microscope, appears to have but one eye; for, on account of the smallness of the head, the two seem to be joined together. When you view them with a lens, however, both appear, and are of a reticulated structure. Its trunk then also is seen, small, sharp, and transparent.

This insect is of a blood red colour; and its numbers, that float on the surface of stagnated water, are sometimes so great, that they give it the appearance of blood. *Swammerdam* mentions an instance in which the people of *Leyden* were greatly alarmed by this colour of the water, deeming it portentous of some great calamity.

* Rhedi Expos. t. 18. † Swammerdam, Quart. p. 66.

## Genus VII.—*Phalangium.*

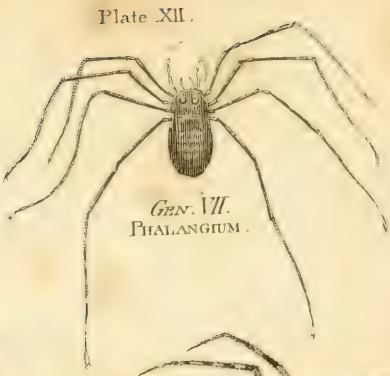
The infects of this family bear a ſtrong reſemblence to the crab: They have eight feet, and four eyes; two on the ſummit of the head, and two on the ſides. The antennæ are fixed to the fore-part of the head, and have the appearance of feet; the abdomen is round *.

Some have imagined that all thoſe threads with which the graſs and ſtubbles in autumn are covered, are the production of the phalangia. So numerous are theſe threads, that in the courſe of one day the whole ſurface of the ground is covered with them. Their uſes to the animal are probably to enſnare its prey, and to aſſiſt it in travelling through the air. Other naturaliſts have ſuppoſed theſe waving threads to be ſpun by a ſpecies of tick called the autumnal weaver.

*Phalangium opilio*, the ſhepherd weaver. The body of this ſpecies is round; above, the colour is a duſky brown; below, a dirty white. The legs are uncommonly long, and ſlender: when caught by one of them, the owner parts with it to ſave his body, and makes off without any apparent uneaſineſs: This is alſo the caſe both with the crab and lobſter, whoſe loſs is quickly repaired by the growth of a new limb. No experiments have yet aſcertained whether the power of reproducing their limbs may not alſo belong to the inſects of this genus.

* Syſt. Nat. p. 1027.

Plate XII.



*Gen. VII.*
PHALANGIUM.

*Gen. VIII.*
ARANEÆ.

*Gen. IX.*
SCORPIO.

## GENUS VIII.—*Aranea. The Spider.*

THE inſects of this family may be conſidered as a kind of *Argufes*, all poſſeſſing eight eyes, and diſtinguiſhable into families by their arrangement and poſition. They have eight feet, and a mouth armed with crotchets. The inſtruments for ſpinning are ſhaped like nipples, and placed in the anus.

But the circumſtance by which the ſpiders are moſt diſtinguiſhed, are the two articulated palpi, which are headed by the genitals of the male in that ſex †. As the ſpiders prey upon each other, except during the time of their amours, they dare not venture within reach of each other, but with the utmoſt caution. They are then ſeen ſtretching out their legs, ſhaking their webs, and tampering with each other, by a ſlight touch with the extremity of the feet; then, in a fright, dropping haſtily down their threads, and returning in a few moments to make a freſh trial by feeling. When once both parties are well aſſured of the ſex they have to deal with, the approaches of their feet to feel become more frequent, confidence takes place, and the inſtant of amorous dalliance enſues ‡.

We cannot, ſays *Lyonnet*, ſufficiently admire how careful theſe animals are, not to give themſelves up blindly to a paſſion, or venture upon an imprudent ſtep, which might prove fatal to them. After the male and female ſpider

† Syſt. Nat. p. 1030. ‡ Barbut, p. 339.

ſpider have thus met, it is aſſerted by the moſt accurate obſervers, that the extremity of the claws of the former opens, by a kind of ſpring, and lets out a white ſubſtance, which he applies beneath the abdomen of the female, and thus accompliſhes the great purpoſe of nature †.

In this country, where all the inſect tribes are kept under by the coldneſs of the climate, or by human aſſiduity, the ſpiders are ſmall in ſize, and comparatively few in number: Here, they are an inoffenſive, as well as a humble tribe; but in the warmer regions of *Africa* and *America*, they are hideous and terrible. There, the ſpiders, as well as all the inſect tribe, acquire a ſize and vigour, which to the inhabitants of the north of *Europe* muſt appear incredible. The abdomen of the *Martinico* ſpider is as large as a hen's egg, and covered all over with hair: Its web is ſtrong; and its bite is dangerous. Happy it is for us, that we are placed at ſuch a diſtance from theſe animals, that we can ſtudy their hiſtory without dreading their reſentment.

The eyes are placed all around the head; they are immoveable, and deſtitute of eyelids, but are fortified with a tranſparent horny ſubſtance, which at once protects and aſſiſts their viſion. A number of eyes ſo unuſual among the reſt of animated beings, ſeems to have been deemed neceſſary to an inſect deſtined to procure its ſupport by the moſt watchful attention. The mouth of the ſpider is equally fitted for his occupation: It conſiſts of two ſerrated pincers, which ſpring from the forehead, and terminate like the claws of a cat. A little below the point of the claw there is a ſmall hole, through which the animal

† Lyonnet and Liſter.

mal emits a poiſon; which, though harmleſs to us, is capable of inſtantly deſtroying its prey.

But all theſe arms of the ſpider, formidable as they are, would prove inſufficient for procuring him ſubſiſtence, did he not add ſtratagem to force. Every one is acquainted with his invention of ſpreading a net for the fly, an inſect which, without this artifice, muſt for ever have eſcaped him. The poſition of the ſpider's web is generally well choſen; being placed either in the corners of rooms, the ſides of windows, or among the branches of trees, where flies are moſt frequent and plenty.

For the conſtruction of this delicate engine, Nature has ſupplied theſe animals with a large portion of a glutinous ſubſtance, which ſhe has granted them the power of ſpinning into a thread ſo delicate, that ninety of them twiſted together are only equal in thickneſs to that of the common ſilk worm. Every thread of the common ſpider's web, though ſcarcely viſible by the naked eye, is compoſed of a vaſt number of ſlender filaments joined together. The inſtruments of this delicate operation are five dugs or teats, with ſmall orifices, capable of being contracted or dilated, according to the fineneſs of the intended thread.

After the net has been thus formed, the next care of its owner is to provide a proper retreat, from which he may ſurvey the whole, and obſerve the ſucceſs of his own artifice. Some threads being in contact with his body, whenever the web is touched from without, he inſtantly feels the motion, and accordingly prepares either for attack or defence. If the inſect invading his territories prove a fly, he immediately ſallies forth, and devours the devoted prey with all that ferocity which diſtinguiſhes

the lion or the tiger. If, however, the aſſault be committed by an enemy ſtronger than himſelf, the ſpider keeps cloſe concealed in his fortreſs; and it is not till the danger is over, that he ventures forth to repair the damages which his property has ſuſtained.

By ſuch accidents, as well as the force of the wind, the labours of many days are often inſtantly deſtroyed; and either the conſtruction of a new web, or a repair of the old, becomes abſolutely neceſſary. Here the ſpider has again recourſe to that glutinous ſubſtance with which he was originally provided. The life of this animal ſeems chequered with misfortunes. The time ſeldom fails to arrive, when the reſerves of gluten, by repeated draining, become entirely exhauſted; and the poor ſpider is left to all the chances and viciſſitudes of want, which often bring him to an untimely end *.

The natural longevity, however, of the ſpider, is greater than ſeems to have been granted to the generality of the inſect tribes. The length of his life is not exactly aſcertained; but it probably endures for ſeveral years. The female, it is ſaid, does not begin to lay her eggs till ſhe has completed her ſecond year; and even then, her brood is not ſo numerous as when ſhe has attained her full maturity. When that period arrives, ſhe has been known to produce near a thouſand eggs in a ſingle ſeaſon. The eggs being thus depoſited, the animal prepares a ſilken bag for their reception, till they are hatched. Thus packed up, ſhe glues them to her body, by means of the ſame adheſive matter with which the web is ſpun; and



* Goldſmith's Nat. Hiſt. Vol. VII.

in this manner they are carried by the parent, like another body attached to her own.

With all this tenderneſs for its young, there is no animal more ferocious, or more powerfully armed for deſtruction than the ſpider: It can deſtroy inſects far above its ſize; and its indiſcriminate rapacity does not even ſpare thoſe of its own kind. *Reaumur*, when he endeavoured to turn the labours of different inſects that ſpin ſilk to the advantage of man, was foiled in all his attempts to domeſticate the ſpider. He provided them with a habitation, and with every kind of food, flies, and blood in the ends of unripe feathers, a morſel of which they are particularly fond: but all was in vain; their malignant nature rendered them unfit for ſociety, and turned them from their food to deſtroy each other. By perſeverance, however, he obtained as much of the ſilk intended for the covering of their eggs, as enabled him to manufacture a pair of gloves of theſe curious materials.

*Aranea hortenſis.* This ſpecies frequents the garden trees, among the branches of which it ſpins its web, and ſtations itſelf in the centre. The body is of a browniſh colour; the eyes very ſmall, and of a violet purple†. With the ſilk of this ſpider *M. Bon* of *Languedoc* contrived to manufacture a pair of ſilk ſtockings, of a fine grey colour, and in ſtrength and elegance nearly equal to thoſe of common ſilk.

*Aranea domeſtica.* This ſpecies inhabits windows and unfrequented apartments; it is oblong, and of a brown colour; the abdomen black. This animal has four ca-



† Liſter, Aran. 83.

vities upon the back, by which it may eaſily be diſtinguiſhed †. Between the nails of the feet there iſſues a clammy liquor, by which it is enabled to climb up glaſs and other ſmooth ſurfaces. The web of this ſpecies is conſtructed of much finer threads. It is ſaid to poſſeſs ſix muſcular nipples, each having a thouſand orifices for letting out the threads ‡. If this be true, each filament of the ſpider's web muſt conſiſt of ſix thouſand threads, which, when united, are ſcarcely viſible to the naked eye.

To this tribe is commonly referred the tarantula, the the largeſt ſpider known in Europe; but rendered ſtill more remarkable by the extraordinary qualities which credulity has aſcribed to it. It is three quarters of an inch in length, the body covered all over with down, generally of an olive duſky brown. The external parts reſemble thoſe of the reſt of the genus: It has eight eyes and as many legs; the front armed with ſerrated pincers.

The bite of the tarantula is ſaid, but without foundation, to be attended with fatal conſequences. After violent pains and ſickneſs, the unhappy victim is ſeized with an involuntary laughter; dances without intermiſſion, exhibiting all the ſymptoms of inſanity. At the return of the ſeaſon in which he was bit, the patient's madneſs begins again to appear; and theſe troubleſome relapſes, after having recurred for ſeveral years, at laſt terminate in death.

Muſic and dancing, as the fiction proceeds, is the only remedy for this dreadful malady. The muſician begins to play a tune famous for the cure, ſlow at firſt, but increaſing

† Fauna Swecica. ‡ Vide Reaumur, Barbut, and Goldſmith.

creaſing in quickneſs as the patient ſeems affected. After continuing this ridiculous, but violent exercife, till a profuſe perſpiration is brought on, the imaginary venom is forced from the ſyſtem, and the cure is completed. Such were the reputed effects of the bite of the tarantula, till travellers of diſcernment traced the whole fiction to the artifice of the peaſants of *Apulia*, who, for a ſmall ſum had been in the habit of allowing themſelves to be bitten, and then counterfeited madneſs, to aſtoniſh the wondering multitude.

## Genus IX.—*Scorpio. The Scorpion.*

We are now to contemplate the manners of an animal, the moſt hideous, and perhaps the moſt formidable of the inſect tribes. There are ſix different ſpecies of the ſcorpion, diſtinguiſhed by their ſize and colour, and the countries where they reſide. Happily for *Britain*, none are found there, but a ſpecies no bigger than a louſe; and even that is extremely rare †. In *Italy*, *Spain*, and the ſouth of *France*, they are frequently to be met with three inches in length, and are conſidered as the greateſt peſts that torment mankind. But the ſize and malignity of the ſcorpions of *Europe* may be deemed trifling, when compared with that of the *African* monſters that are diſtinguiſhed by that name. Along the *Gold Coaſt* they are ſometimes found larger than a lobſter, and their ſting is inevitably fatal ‡. From the language of Scripture, too, we find that in the eaſt theſe animals have long been formidable to mankind. In *Batavia*, they ſometimes grow twelve inches in length; and in removing furniture, behind which they ſkulk, there is the utmoſt danger of being ſtung.

The genus of ſcorpions is characteriſed by eight eyes, three of which are placed on each ſide of the thorax, and two

† Barbut's Gen. Inſ. p. 351. ‡ Boſman's Travels.

two almoſt contiguous upon the back. Beſides eight feet, they have two palpi, each armed at the extremity with a forceps. The tail is lengthened out by different articulations, the laſt terminating in a ſharp and crooked ſting.

*Scorpio Aſer.* This terrible and venomous animal is an inhabitant of *Africa*: Its colour is a deep gloſſy brown; the ſegments of which the body is compoſed, each terminate in a band of bright yellow; while the two eyes ſparkle in the back like diamonds. Its appearance bears a ſtrong reſemblance to the looſter. Moſt of the travellers who have viſited *Africa* repreſent this animal not only as poiſonous, but exceedingly iraſcible; and the effects of its reſentment, unleſs ſpeedily relieved, become fatal †.

It is to *M. de Mauperiais* that the public is indebted for the firſt accurate and philoſophical account of theſe animals. According to him, they are all viviparous; the body of the pregnant female exhibiting, when opened, between forty and fifty living young Each of theſe is ſeparated from the reſt by a thin membrane, while all are united by a common filament. In order to aſcertain the venom of their ſting, that philoſopher bred a great number together, and let them looſe upon dogs and other animals; and he found that ſometimes the ſting was ſo empoiſoned as to ſwell the whole body of the wounded animal; and in that caſe it brought on violent retching, convulſions, and death. At other times, whether from the difference of food, or ſome other cauſe, he found their ſting harmleſs.

The

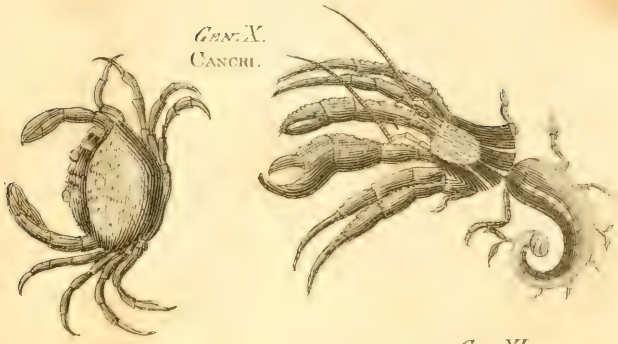
† Leba and Moore.

The common food of the ſcorpion are worms, flies, and ſpiders. The *Italian* ſcorpion, when incloſed with the latter animal in a glaſs bottle, exhibits a dreadful combat, which terminates in favour of the ſcorpion. After having ſtung his adverſary to death, he cuts off his limbs with his claws, and then ſucks the juice from his body †. No obſervations nor experiments of naturaliſts have yet enabled them to aſſign the cauſe why the ſting of the ſcorpion, which at one time is fatal, proves harmleſs at another; nor has the medical art yet found out any certain antidote againſt its malignity. The efficacy of the oil of ſcorpions, and ſome other remedies that are uſed, is perhaps rather to be aſcribed to want of activity, or the total abſence of the poiſonous matter.

† Ephemeſ. Dec. II. 1687. Obſerv. 224.

Plate XIII.

*Gen. X.*
Cancri.



*Gen. XI.*
Monoculus.

*Gen. XII.*
Onisci.

*Gen. XIII.*
Scolopendra.

*Gen. XIV.*
Juli.

## Genus X.—*Cancer*. *The Crab*.

After the example of *Linnæus*, we place the crab among the inſects, becauſe it is poſſeſſed of ſome of the invariable characters of this claſs of beings. All the eighty-ſeven different ſpecies of crabs are diſtinguiſhed in poſſeſſing two members performing the office of hands, and terminating each in a forceps. They have generally eight feet, and two moveable eyes, projecting from the head, or placed upon a pedicle or ſtalk. The two palpi are armed with claws; the tail is articulated, and unarmed.

In general, the crabs are aquatic animals, whoſe reſidence is in the ſea: Some, however, are known to frequent rivers; and in *America*, there are ſome ſpecies wholly terreſtrial; theſe are commonly about four inches long, and feed upon leaves. The liquid ſubſtance found in their ſhell cures the bliſters that are raiſed on the ſkin by the milky ſubſtance that exſudes from the mancellina tree. The ſavages apply the fat, when melted down, as a ſpecific againſt the rheumatiſm†.

*Cancer Bernardus*, the St. Bernard or hermit crab. This ſpecies is ſmall in ſize, and ſemicruſtaceous. As it has no ſcales to defend it, it takes up its dwelling in the empty ſhells found lying upon the ſhore. Of theſe it tries various kinds, till at length one is pitched upon, fitted

† Barbut's Gen. Inſ. p. 358.

fitted to its ſhape and ſize: the increaſe of its bulk, however, ſoon forces it to exchange this for a different and more capacious habitation; again, therefore, it ſallies forth in queſt of a new manſion. Should it meet with another crab engaged in the ſame purſuit, they frequently are ſeen quarrelling for the ſame ſhell. This battle, *pro aris et focis*, often proves obſtinate, till the vanquiſhed ſneaks off; and the empty apartment becomes at laſt the prize of the victor. Of the houſe thus obtained, they are ſo tenacious, that nothing but heat will diſengage them from their retreat. When caught, they pinch forcibly, and utter a faint cry.

*Cancer curſor.* This animal has obtained its name from the nimbleneſs with which it runs. It is amphibious, leaving the ſea towards noon, and parading upon the ſhore; from which, however, it ſpeedily makes its retreat on the approach of danger †.

The common lobſter belongs to this genus, the ſpecies of which are far more numerous than naturaliſts have yet allowed. This animal is ſo well known, that a deſcription of it can hardly be neceſſary. It is found all around the ſhores of *Britain*, frequenting particularly the ſtony ground, where it is caught by a creel or willow-work of a particular conſtruction, that admits of its entering, but precludes any return. The bait by which it is enticed into this priſon is fiſh guts.

Every lobſter is ſuppoſed to be ſelf impregnated, and to exhibit an example of an hermaphrodite of the moſt perfect kind. The ovary where the ſpawn is firſt produced, lies towards the tail, and is filled with that red ſubſtance,

† Barbut, ubi ſupra.

ſubſtance, each particle of which is the embryo of a future animal. When they are firſt excluded from the belly, they are placed under the tail, where the parent animal protects them from danger, till they acquire limbs and animation. In that ſtate, they drop off into the water, when yet very ſmall, and betake themſelves to the crevice of a rock for ſhelter, till they are enabled by greater ſtrength to ſearch for their prey. When full grown, their voracity is ſo mercileſs and indiſcriminate, that they mutually devour each other.

The lobſters, like all other inſects, poſſeſs antennæ, and like theſe animals change their external covering once a-year: To them, this is a painful and tedious operation. The lobſter continues growing, while its cruſt continues unalterably the ſame: hence it ſoon becomes too large for its habitation, and is neceſſitated to get free. During their transformation, all their vigour and activity ceaſes; and they no ſooner feel its approach, than they betake themſelves to ſome retired ſituation, where they may be ſafe from the attacks of their enemies. The claws, and even the ſtomach, are ſaid to be changed in this convulſive effort of nature. Before caſting the ſhell, the animal throws itſelf upon its back, ſtrikes its claws againſt each other, and every limb ſeems to tremble; its feelers are agitated, and its whole body is in violent motion. It then ſwells itſelf in an unuſual manner, and at laſt the ſhell is ſeen beginning to divide at its junctures, particularly at the belly, where it was leaſt firmly united †.



† Goldſmith's Nat. Hiſt. Vol. VI. p. 363.

In this painful manner does the lobſter attain its liberty; but ſo feeble is its condition, that it remains for hours motionleſs, from the fatigue of the operation. Many die in this violent criſis of their exiſtence: Such as ſurvive keep cloſe to their dens for ſeveral days, ſhunning danger with all the timidity of worms, whoſe ſoftneſs and imbecility they then acquire.

## Genus XI.—*Oniſcus.*

This is a diminutive, but harmleſs tribe of animals: They are diſtinguiſhed by having fourteen feet, ſetaceous antennæ, and the body of an oblong form. *Linnæus* has enumerated fifteen ſpecies, ſome of which are terreſtrial, and others aquatic †.

*Oniſcus aquaticus.* This inſect is found in wells and ſtagnated pools ‡. The body is compoſed of ſeven articulations, beſides the head and tail; the laſt is much larger than any of the reſt. The ſhape of the animal is flat and round: From each ſide there ſpring ſeven feet, each growing longer as you approach the tail ||.

The ſea oniſci are larger than thoſe of the freſh water, having ten inſtead of ſeven ſegments. Their motions in the water are rapid; for beſides the feet, they are aſſiſted by lateral threads, which puſh them forward like the oars of a boat. Among them, copulation endures for ſeveral days; when the male ſeizes his female with his two fore feet, and drags her along with him wherever he directs his courſe; and nothing can induce him to leave his female till this operoſe function is diſcharged. A few days after impregnation, the female diſcovers a diſtended belly; on the ſeventh, the young iſſue alive from her

† Syſtema Nat. p. 1059. ‡ Rai Inſ. p. 43.
|| Regne Animale, p. 250, ſp. 4.

her womb, and ſwim around with alertneſs and animation.

All this while, the male, it is ſaid, continues fixed upon his female, not for the purpoſe of fecundation, but of aſſiſting her to caſt her ſlough; a good office; in which he is not ſucceſsful till he has exerted the whole of his ſtrength.

On her firſt appearance after leaving her coat, the female is entirely white; her ſlough, of a deep aſh-colour, is left floating upon the ſurface, and ſo entire, that you would imagine it to be the real animal. This tranſformation being completed, the male leaves his female, and unaſſiſted undergoes a ſimilar change.

*Oniſcus domeſtica.* This inſect inhabits damp houſes and walls, and muſt have been ſeen by every perſon. The upper part of the body is dark brown, the belly grey. Two varieties of this animal are found in the fields, having each, like it, the body divided into ten ſegments, excluſive of the head and tail. The latter part terminates in two appendices *. The land oniſci are all ſuppoſed to be oviparous, while the aquatic produce living young. For ſome time after being excluded from the ſhell, the former are often of a pale red colour. The domeſtic oniſcus is gathered for medicinal purpoſes †.

* Charleton Exercit. 54. † Vide Barbut, p. 365.

## Genus XII.—*Scolopendra.*

This tribe has in the *Latin* language obtained the name of *mille-pes*, from the extraordinary number of feet with which nature has provided ſome of its ſpecies; one kind of the ſcolopendra having no leſs than an hundred on each ſide. In general, the feet of theſe inſects are as numerous as the ſegments into which their bodies are divided. They have the antennæ ſetaceous, articulated palpi, and the body depreſſed or flattened †. Of this hideous race there are eleven different ſpecies, diſtinguiſhed by their form, ſize, and colour. Some live beneath the bark of decayed trees, or are found below ſtones and garden boxes; others inhabit the freſh and ſalt water, and are all remarkable for their quick progreſſive motion.

*Scolopendra forficata.* The feet of this ſpecies are fifteen on each ſide; the laſt longer than the reſt, and turning backwards, form a forked tail. The body is of a dun colour, ſmooth, and compoſed of nine ſcaly ſegments, without reckoning the head ‡.

The marine ſcolopendra ‖ in form ſomewhat reſembles the leech; it builds thoſe ſmall edifices of a brittle and porous texture which are ſeen upon the ſhore at low water. Theſe maſſes are compoſed of a number of ſmall funnels,

† Syſt. Nat. p. 1062. ‡ Barbut's Gen. Inſ. p. 367.
‖ Vide Rai Inſ. p. 44.

funnels, each having the aperture closed up with a covering of sand, to protect the inhabitant from danger.

In the *East Indies* and *America*, there are scolopendræ from four to six inches long, and as thick as the finger: When of that bulk, they appear truly hideous, and their sting is reckoned as dangerous as that of the scorpion. Some of these animals are said to be without eyes, and to direct their course by means of two feelers that extend beyond the head. It has been asserted, too, that when cut into pieces, each segment, like those of the polypi, is capable of reproducing an entire animal *.

* Barbut, ubi supra.

## GENUS XIII.—*Tulus.*

THIS tribe ſo nearly reſembles the former, that in the Fauna Swecica they are both included under one genus. The feet of the tuli are ſtill more numerous than thoſe of the ſcolopendra, being, on each ſide, twice as many as the ſegments of the body. The antennæ are moniliform, the palpi articulated, and the body of a ſemicylindrical form.

*Tulus ſabuloſus* *. This ſpecies has no leſs than two hundred and forty feet, although its length is not more than an inch. It is of an aſh-colour, and ſmooth; the body compoſed of ſixty ſegments, each giving off two pair of ſmall white feet. The antennæ of this inſect are ſhort, and conſiſt of five rings. When the animal is touched, it wraps itſelf up into a round ball, the feet all turned inward.

*Millepeda orientalis* †. This is the largeſt of all the tuli, being as long and as thick as a man's finger: The head is ſmall, and obtuſe, the antennæ clavated, and the eyes black; the body is of a pale colour, and divided in forty-three ſegments, each having a pair of feet on every ſide, the whole amounting to an hundred and ſeventy-two ‡.

* Rai Inſ. p. 47. † Seba, I. p. 131.
‡ Regne Anim. p. 253. ſp. 3.

*THE END.*

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